CHARLES D. BAKER
GOVERNOR

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LIEUTENANT GOVERNOR

MIKE KENNEALY
SECRETARY OF HOUSING AND ECONOMIC DEVELOPMENT

Commonwealth of Massachusetts
Division of Professional Licensure
Office of Public Safety and Inspections
1000 Washington Street • Boston • Massachusetts • 02118

JOHN C. CHAPMAN
UNDERSECRETARY OF CONSUMER AFFAIRS AND BUSINESS REGULATION

CHARLES BORSTEL
COMMISSIONER, DIVISION OF PROFESSIONAL LICENSURE

BOARD OF BUILDING REGULATIONS AND STANDARDS
NOTICE OF MEETING

In accordance with the provisions of G.L. c. 30A § 20, notice is hereby given that the Board of Building Regulations and Standards (BBRS) will convene a regular monthly meeting on:

January 8, 2019 @ 10:00 a.m. until approximately 1 p.m.
@
The Boston Society of Architects (BSA)
290 Congress Street - Suite 200, Boston, MA 02210

Posted on January 3, 2019

It is anticipated that the topics shown below will be discussed at the aforementioned meeting:

AGENDA

Roll Call, by BBRS Chair:

John Couture, Chair	☐ present ☐ absent	Robert Anderson, or designee	☐ present ☐ absent
Kerry Dietz, Vice Chair	☐ present ☐ absent	Peter Ostroskey, or designee	☐ present ☐ absent
Richard Crowley, Second Vice Chair	☐ present ☐ absent	Michael McDowell	☐ present ☐ absent
Steve Frederickson	☐ present ☐ absent	Susan Gleason	☐ present ☐ absent
Kevin Gallagher	☐ present ☐ absent	Lisa Davey	☐ present ☐ absent
Cheryl Lavalley	☐ present ☐ absent		

1. **Review\Vote** approval of December 11, 2018 BBRS draft meeting minutes.
2. **Review\Vote** approval of November & December, 2018 BOCC draft meeting minutes.
3. **Review\Respond** to open meeting law violation claims made by Town of Douglas Administrator, Matthew J. Wojcik and draft response denying said claims.
4. **Review\Ratify** letter sent to Town of Douglas Administrator Matthew J. Wojcik on December 20, 2018 regarding the Town's obligation to employ and designate a Building Commissioner who meets the BBRS' certification requirements and noting that no business entities are so certified.
5. **Review\Vote** approval of the 2018 International Energy Conservation Code (IECC) as modified by Massachusetts proposed amendments, inclusive of the Stretch Energy Code, in accordance with Massachusetts General Law (MGL) c143, §94(o). The 2018 IECC may be viewed @ https://codes.iccsafe.org/content/IECC2018P2.

- **Proposal Number 12-1-2018** – Consider revising Sections N1103.3.3 (R403.3.3).
  Proponent: Catherine Flaherty, *Air Conditioning Association of New England* (ACCA), *Inc.*

- **Proposal Number 12-2-2018** – Consider revising Sections N1103.6.2.
  Proponent: Catherine Flaherty, ***Air Conditioning Association of New England*** (ACCA), ***Inc.***
- **Proposal Number 12-3-2018** – Consider revising Sections R806.5.
  Proponent: David Weitz, ***CLEAResult for Mass Save.***
- **Proposal Number 12-4-2018** – Consider adoption of the 2018 IECC as required by c143, §94(o).
  Proponent: Department of Energy Resources (DOER) and others.

6. **Discuss** progress relating to the next edition of 780 CMR.
7. **Review** presentation of the ***International Green Construction Code*** (IgCC). The 2018 IgCC may be viewed @ https://codes.iccsafe.org/category/I-Codes?year[]=2018&page=2.
8. **Discuss** progress of Manufactured Buildings Study Group.
9. **Discuss** approval of 152 new CSLs issued in the month of December, 2018.
10. **Discuss\Vote** Draft FAQ for Residential Code pertaining to Sections R105.3.1.1, R322, AJ101.3
11. **Discuss\Vote**
    CSL Average Passing Score\Medical\Military\Age or Continuing Education Requirements.
    - None this month.
12. **Review\Approve** CSL Exam Transition Team members.
13. **Review\Approve** Dave Sullivan to serve as BBRS representative for February BOCC meeting.
14. **Review\Discuss** Board of Building Regulations and Standards Member Handbook including reminders regarding the Open Meeting Law.
15. **Vote** BBRS chair and vice-chair.
16. **Discuss** other matters not reasonably anticipated 48 hours in advance of meeting.

Public Comments Received About Proposed IECC 2018 As Amended

Anderson, Robert (DPL)

To: C. Scott Ananian
Subject: RE: Comments on EV provisions in draft amendments to the Massachusetts State Building Code found at 780 CMR 13.00, 51.00, and 115.00

From: C. Scott Ananian [mailto:brookline@cscott.net]
Sent: Friday, December 14, 2018 4:57 PM
To: Anderson, Robert (DPL); Anderson, Robert (DPL)
Subject: Comments on EV provisions in draft amendments to the Massachusetts State Building Code found at 780 CMR 13.00, 51.00, and 115.00

I am an EV owner and Town Meeting Member for Brookline, MA. We have been working since 2016 to support the rapid adoption of Electric Vehicles in our town.

I previously submitted comments on the draft amendments as posted to the BBRS site before the Dec 11 public hearing. At that hearing I was provided with a copy of the more recent EAC revision to the EV provision. The below comments apply to that revision.

1. I remain appreciative that the BBRS is tackling the issue of electric vehicle charging facilities in our buildings. This is an essential function of state government, and I am hopeful that the standardization of sound and safe charging facilities will be a boon to electrification in our state, which is vital to achieve our Massachusetts climate change goals.

2. I am pleased to see that the omission of single- and two-family homes from EV requirements was an oversight, and seems to be clarified in the latest EAC draft by explicit text in Table R404.2 noting that 1- and 2-family homes are intended to be included in category R-3. I believe this is sufficient to clarify the intention of the BBRS. However, because R-3 is a term defined in the IBC, and 1- and 2-family homes are generally not covered by the IBC but instead by the IRC, I wonder if additional clarification might be needed.

3. In this revision, the specification of standard NEMA connectors (NEMA 14-50 and NEMA 6-50) have been omitted from the specification. In conversation with DOER, it appears that the intent is to perhaps reintroduce this requirements as part of an electrical code revision to that would follow from this. I strongly encourage the BBRS to specify a standard outlet or two as part of the spec. It is already common for EV owners to carry around a half dozen different plug adapters in order to be sure they are able to charge wherever they go. (See https://www.evseadapters.com/collections/tesla-model-s-and-x-gen-1-charging-adapters for a taste of the plethora of possibilities.) I believe setting a standard here is an opportunity to ease EV adoption that should not be wasted. Reducing the possibilities to one (or two) would greatly simplify matters for EV dealers and owners, and ensure that unsafe adapters aren't pressed into use.

4. The flexibility to provide 3 15A outlets in lieu of the single 50A outlet for commercial spaces is a worthwhile addition. It will increase the effective number of EV spaces where long dwell times are expected. Perhaps the language should be clarified that it is not just 3 *circuits* that are to be provided, but 3 *parking spaces*. The MA Architectural Accessibility Board is expected to follow up on the BBRS amendments with appropriate requirements for accessible EVSE charging, following the model that California has enacted. If you are replacing one 50A EVSE space with 3 15A EVSE spaces, we may need to eventually specify how many of them need to be accessible. Ensuring the language speaks of *spaces* not *circuits* will make this ore clear.

5. I don't think the "replace 1 with 3" language in the commercial code is always appropriate in the residential code. For high density housing, it may be warranted, but for single- and two-family homes I worry that the builder will put three outlets in the garage and consider their job done. I think there should always be at least one 50A circuit available to the homeowner. I suggest adding "except for single- and two-family homes" to exception 3 in R404.2.

6. Finally, I wish to reiterate my support for a 50A circuit and 50A-rated receptacles. First the 50A circuit provides essential future-proofing for high-battery-capacity electric vehicles. It is worthwhile to settle now on a standard that will last for some decades, rather than find we need to bump the circuit capacity up to 50A later and have EV owners forced to contend with mismatched outlets and circuits. (See my argument above for standardized receptacles.) Second, the fundamental reason the building code treats EVSE is to ensure safety. The 50A outlets are commonly and inexpensively available due to their decades-long use on RVs. They should be matched to a 50A circuit. Doing otherwise invites trouble -- putting a 50A rated receptacle on a 40A circuit (as has been proposed, for example) will inevitably cause users to try to connect a 50A load. This is unsafe. Further, current car chargers are "smart" and limit the car charging current to the maximum safely allowable under continuous duty, based on the plug which is attached to the car charger. That is, if you use the car charger plug that fits a NEMA 14-50 receptable, the car automatically limits current draw to 40A; if you use the car charger plug that fits a househouse 15A circuit, the current draw is automatically limited to 12A (capacity is derated 80% in all cases to account for continuous duty use). Mismatching the circuit capacity and plug type makes it impossible for the charger to properly limit its current draw.

Thank you for the opportunity to make these comments on the proposed amendments.

-- C. Scott Ananian, 103 Griggs Rd, Brookline MA
Brookline Town Meeting member precinct 10

Anderson, Robert (DPL)

From: Alistair Pim <apim@necec.org>
Sent: Friday, December 14, 2018 4:14 PM
To: Anderson, Robert (DPL)
Subject: Fwd: NECEC Comments for for BBRS in support of EV-Ready Provisions
Attachments: NECEC Comments to BBRS 14Dec2018 FINAL.pdf

Dear Mr Anderson
Please see a revised version of our comments with the "'Draft" watermark removed. No other changes were made
Please also accept my apologies for any inconvenience
Sincerely
Alistair Pim

Alistair Pim
Vice President, Innovation & Partnerships, NECEC
NECEC – *Your Partner in the Clean Energy Economy*
Northeast Clean Energy Council & NECEC Institute
250 Summer Street, 5th fl., Boston, MA 02210
M 508 341 3723
apim@necec.org
www.necec.org
Follow NECEC: Blog, Twitter and LinkedIN

---------- Forwarded message ---------
From: **Alistair Pim** <apim@necec.org>
Date: Fri, Dec 14, 2018 at 4:02 PM
Subject: NECEC Comments for for BBRS in support of EV-Ready Provisions
To: <Robert.Anderson@mass.gov>
Cc: Peter Rothstein <prothstein@necec.org>, Janet Besser <jbesser@necec.org>, Jamie Dickerson <jdickerson@necec.org>

Dear Mr Anderson
We appreciate the opportunity to provide the Board of Building Regulations & Standards with comments on the proposed EV Ready requirements included in the amendments to Chapters 13 and 51. NECEC strongly supports including EV Ready language requirements in Massachusetts State building Code.
Please find attached our written comments on behalf of members of our Clean Transportation Working Group, which include several EV Charging companies.
Sincerely
Alistair Pim

Alistair Pim
Vice President, Innovation & Partnerships, NECEC

NECEC – *Your Partner in the Clean Energy Economy*
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necec
Your Partner in the Clean Energy Economy

December 14, 2018

Charles Borstel, Commissioner
Division of Professional Licensure
1 Ashburton Place, Rm. 1301
Boston, MA 02108

John Couture, Chair
Board of Building Regulations & Standards
1000 Washington St, Suite 710
Boston, MA 02118

Re: NECEC Comments to BBRS in Support of EV-Ready Provisions

Dear Commissioner Borstel and Chairman Couture:

NECEC appreciates the opportunity to provide the Board of Building Regulations & Standards ("BBRS", or "the Board") with comments on the proposed "EV Ready" requirements included in the amendments to Chapters 13 and 51. NECEC strongly supports including "EV Ready" requirements in Massachusetts State Building Code. We respectfully urge the language being considered by the Board of Building Regulations and Standards to be amended to be technology-neutral and to include such technology-neutral provisions in the State Building Code.

NECEC is the lead voice for hundreds of clean energy companies across the Northeast, helping to grow the clean energy economy. NECEC's mission is to create a world-class clean energy hub in the region delivering global impact with economic, energy and environmental solutions. NECEC is the only organization in the Northeast that covers all of the clean energy market segments, representing the business perspectives of investors and clean energy companies across every stage of development. NECEC members span the broad spectrum of the clean energy industry, including solar, wind, energy efficiency, energy storage, electric vehicles and clean transportation, combined heat and power (CHP), fuel cells, and advanced and "smart" technologies. Our members are already – or are very interested in – doing business in the Commonwealth and helping to grow our clean energy economy.

I. Background

Electric vehicles are revolutionizing the transportation system in a way that puts buildings at the heart of refueling. Over 90% of charging has been shown to take place at home and at work during extended periods of time. Given the Commonwealth's commitment to deploying 300,000 zero-emissions vehicles by 2025, it is essential that we prepare our buildings and communities to facilitate and support achievement of this commitment in a safe, reliable, and cost-effective manner.

"EV Ready" requirements in the state building code will save money for property owners and future-proof Massachusetts businesses, workplaces, retail properties, and homes. A recent study commissioned by the Northern California utility Pacific Gas & Electric found that the cost of retrofitting an existing building with EV ready spaces is 2.75 to 4 times more expensive than including them at the time the building is built:

> "Installing infrastructure during new construction can avoid retrofit costs including breaking and repairing walls, longer raceways (also referred to as conduit) using more expensive methods and upgrading electric service panels. In addition, the soft costs

such as permitting and inspections and project management are much lower for new construction."[1]

"EV Ready" requirements as drafted typically do not require EV charging stations to be purchased or for parking spots to be exclusively dedicated for EV charging stations. Rather, "EV Ready" provisions often require the installation of conduit and wiring and to ensure sufficient electrical capacity to support the future installation of EV chargers by site hosts, at their expense, at a later date.

The Massachusetts Legislature identified that "EV Ready" requirements would be appropriate components of the state building code. Section 3 of Chapter 448 of the Acts of 2016 explicitly authorized the Board to consider and adopt EV Ready requirements into the building code. NECEC encourages the Board to exercise its statutory authority to adopt EV Ready requirements.

II. Recommendations

Before the Board adopts the proposed EV Ready requirements, NECEC respectfully requests a series of amendments to the draft language, which are outlined in the Appendix.

III. Conclusion

Thank you for your consideration of our comments. For the above-referenced reasons, we strongly encourage the Board to adopt the EV Ready requirements with the amendments included in the Appendix. Thank you for the opportunity to provide these comments and for your consideration of this critical issue. Please do not hesitate to contact us if you have any questions or we can provide any assistance.

Sincerely,

Peter Rothstein
President

Janet Gail Besser
Executive Vice President

Cc: Alistair Pim, NECEC
Jamie Dickerson, NECEC

[1] Energy Solutions & Pacific Gas and Electric (November 2016), "Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report for San Francisco." Retrieved from: http://evchargingpros.com/wp-content/uploads/2017/04/City-of-SF-PEV-Infrastructure-Cost-Effectiveness-Report-2016.pdf

Appendix: Recommended Amendments to Proposed EV Ready Requirements

Residential Building Code.[2] It would be inappropriate to specify the circuit termination for an EV Ready circuit. Requiring certain termination points for circuits would increase the cost of EV Ready requirement for developers and could increase costs for consumers that want to install EV charging stations. We also recommend that the amperage requirement be increased to 60A in order to future-proof buildings for increasing EV charging capabilities.

Language to delete: ~~*EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.*~~

Language to add: In accordance with 527 CMR and this section, buildings shall provide sufficient electrical capacity and physical capacity at the service panel to accommodate future simultaneous vehicle charging for the identified number of spaces identified in C405.9.3. Calculated spaces shall be rounded up to the nearest whole number. A minimum 60-ampere branch circuit shall be installed to terminate in close proximity to each proposed location of future installation of Society of Automotive Engineers (SAE) standard J1772-approved Level 2 electric vehicle service equipment. The circuits shall have no other outlets. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point. The location and number of "EV READY" parking spaces shall be identified on construction documents.

Non-Residential[3]. For similar reasons, the BBRS should strike language that would mandate a specific termination point for a branch circuit.

---

[2] Chapter 13, p. 4
[3] Chapter 51, p. 4

Language to delete: ~~*"EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector."*~~

Language to add: In accordance with 527 CMR and this section, buildings shall provide a 40-ampere branch circuit to accommodate a future dedicated Society of Automotive Engineers (SAE) standard J1772-approved Level 2 EVSE for the number of EV Ready spaces provided in accordance with Table N1104.2 (R404.2). The circuits shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Exceptions to the EV Ready Requirement. Several exceptions to EV Ready requirements in the building code present significant concern and should be struck entirely.

- *Parking separated by right-of-way.*[4] This broad exemption from EV Ready requirements for any building with parking that is not onsite. This would defeat the purpose of an EV Ready requirement and make it harder for multifamily residents, workplace, and commercial tenants to take advantage of transportation electrification.

  Language to delete: ~~This requirement will be considered met if all spaces which are not EV Ready are separated from the meter by a public right-of-way.~~

- *Distance from Panel and Separation by Right of Way.*[5] Similarly, the BBRS should strike these overly-broad exceptions that are in conflict with the purpose of an EV Ready requirement.

  Language to delete: ~~This requirement will be considered met if all spaces which are not EV Ready:~~

  ~~a. Are located more than 130 ft. from the nearest electrical panel or sub-panel location, or~~
  ~~b. Are separated from the premises by a public right-of-way~~

- *Shorter-term Parking.*[6] This overly-broad exemption would exclude parking spaces "limited to parking durations of less than an hour." This would be inappropriate because (1) decisions about final use of parking spaces are not typically made by developers and (2) there are many appropriate use-cases for EV charging at short-term parking.

  Language to delete: ~~"Parking spaces which are limited to parking durations of less than an hour."~~

[4] Chapter 13, P. 4
[5] Chapter 51, p. 4
[6] Chapter 13, P. 4

Anderson, Robert (DPL)

From: Emily Wier <ewier@greenlots.com>
Sent: Friday, December 14, 2018 4:34 PM
To: Anderson, Robert (DPL)
Cc: Thomas Ashley
Subject: Greenlots Comments on EV Ready Building Codes
Attachments: Greenlots BBRS EV Ready Building Code Comments.pdf

Dear Robert,

Please find attached letter from Greenlots in support of EV Ready Building Codes. We encourage the BBRS to adopt these provisions in the IECC, and look forward to supporting their implementation.

Kind regards,

Emily Wier
Policy and Market Development, Greenlots
ewier@greenlots.com
619.952.2331

greenlots®

December 14, 2018

Charles Borstel, Commissioner
Division of Professional Licensure
1 Ashburton Place, Rm. 1301
Boston, MA 02108

John Couture, Chair
Board of Building Regulations & Standards
1000 Washington St, Suite 710
Boston, MA 02118

RE: Support for Massachusetts EV Ready Building Codes

Dear Commissioner Borstel and Chairman Couture,

Greenlots appreciates the opportunity to provide the Division of Professional Licensure and Board of Building Regulations & Standards (BBRS) with comments on the proposed "EV Ready" requirements included in the amendments to Chapters 13 and 51 of the International Energy Conservation Code (IECC).

Greenlots is a leading provider of EV charging software and services, and our smart charging solutions help site hosts and utilities manage dynamic EV charging loads. We leverage numerous partnerships to achieve successful charging solutions, and support a significant percentage of the DC fast chargers in North America and an increasing percentage of Level 2 infrastructure. We are proud to support the deployment of EV charging throughout Massachusetts.

Importance of Transportation Electrification

Massachusetts is a leader on transportation electrification, and increased adoption of EVs will be critical to meet the Commonwealth's climate change goals. Almost 18,000 EVs have been sold in Massachusetts to date, and sales are increasingly trending toward all-battery EVs.[1] The Commonwealth has one of the highest rates of EV ownership, thanks in part to the state's EV rebate and recently approved multimillion-dollar EV infrastructure programs from Eversource and National Grid.[2] New vehicles on the market have more than a 200-mile range, and electric pick-up trucks will be available soon.

Today, most EV charging occurs at home or at work but because vehicle battery size is increasing, a standard 120-volt outlet does not provide enough electricity to fully charge the vehicle during a typical charging session. Access to a 240-volt outlet will be essential, particularly as the costs associated with wiring and trenching can be cost prohibitive when a retrofit is needed. Many other states and municipalities are taking bold steps to adopt EV ready building codes, including California, Atlanta, San Francisco, Los Angeles, and Vancouver. Because of Massachusetts' role as a market catalyst outside of the West Coast, the BBRS should use this opportunity to adopt the "EV Ready" building code requirements.

High Cost of Retrofits

The imperative for "EV Ready" building codes is magnified by the high costs of retrofits. Based on one study, retrofits can range from $3,600 to $10,200 per parking stall (excluding the EV charging hardware), depending on the site's electrical constraints and other factors. New builds, in contrast, only add around $800 per parking space, yielding significant cost savings. When EV charging is integrated as part of the

[1] https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/
[2] https://www.nrdc.org/experts/noah-garcia/massachusetts-approves-new-ev-program

building design, the costs associated with EV Ready infrastructure add very little to the overall construction costs (estimated at 0.87% for residential and 2.01% for commercial buildings).

Most buildings last about 50-60 years, which means that buildings constructed today will be retiring from the housing stock and building infrastructure around 2070. As such, it will be prudent to develop building codes that will enable charging for an increasing number of electric vehicles. Due to the inertia associated with building codes and infrastructure lock in, future-thinking building codes will be essential to plan for EV growth and the Commonwealth's needs.

Furthermore, building owners and tenants incur additional costs associated with EV Ready retrofits. This includes additional time associated with the installation, delays in approval, complications with reassigning parking spaces, and other inconveniences. More and more EV drivers are selecting apartments based on where they can park and charge their EV. This creates a competitive advantage for some building owners.

Recommended Amendments to Proposed EV Ready Requirements

While we support the "EV Ready" requirements as written, we respectfully request that the Board considers code amendments to the IECC which we feel better reflects technology needs, electrical capacity, and remove unnecessary exceptions to the code.

Residential Building Code.[3] It would be inappropriate to specify the circuit termination for an EV Ready circuit. Requiring certain termination points for circuits would increase the cost of EV Ready requirement for developers and could increase costs for consumers that want to install EV charging stations. We also recommend that the amperage requirement be increased to 60A in order to future-proof buildings for increasing EV charging capabilities.

> *Language to delete*: ~~*EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.*~~
>
> *Language to add*: In accordance with 527 CMR and this section, the identified number of spaces at the identified in C405.9.3 shall provide sufficient electrical capacity and physical capacity at the service panel to accommodate future simultaneous vehicle charging. Calculated spaces shall be rounded up to the nearest whole number. A minimum 60-ampere branch circuit shall be installed to terminate in close proximity to each proposed locations of future installation of Society of Automotive Engineers (SAE) standard J1772-approved Level 2 electric vehicle service equipment. The circuits shall have no other outlets. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point. The location and number of "EV READY" parking spaces shall be identified on construction documents.

[3] Chapter 13, p. 4

Non-Residential[4]. For similar reasons, the BBRS should strike language that would mandate a specific termination point for a branch circuit.

Language to delete: ~~*EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.*~~

Language to add: In accordance with 527 CMR and this section, the number of EV Ready spaces provided in accordance with Table N1104.2 (R404.2) shall provide a 40-ampere branch circuit to accommodate a future dedicated Society of Automotive Engineers (SAE) standard J1772-approved Level 2 EVSE. The circuits shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Exceptions to the EV Ready Requirement. Several exceptions to EV Ready requirements in the building code present significant concern and should be struck entirely.

Parking separated by right-of-way.[5] This broad exemption from EV Ready requirements for any building with parking that is not onsite. This would defeat the purpose of an EV Ready requirement and make it harder for multifamily residents, workplace, and commercial tenants to take advantage of transportation electrification.

Language to delete: ~~This requirement will be considered met if all spaces which are not EV Ready are separated from the meter by a public right-of-way.~~

Distance from Panel and Separation by Right of Way.[6] Similarly, the BBRS should strike these overly-broad exceptions that are in conflict with the purpose of an EV Ready requirement.

Language to delete: ~~This requirement will be considered met if all spaces which are not EV Ready:~~
~~a. Are located more than 130 ft. from the nearest electrical panel or sub-panel location, or~~
~~b. Are separated from the premises by a public right-of-way~~

Shorter-term Parking.[7] This overly-broad exemption would exclude parking spaces "limited to parking durations of less than an hour." This would be inappropriate because (1) decisions about final use of parking spaces are not typically made by developers and (2) there are many appropriate use-cases for EV charging at short-term parking.

Language to delete: ~~Parking spaces which are limited to parking durations of less than an hour.~~

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[4] Chapter 51, p. 4
[5] Chapter 13, P. 4
[6] Chapter 51, p. 4
[7] Chapter 13, P. 4

Thank you for your consideration. Greenlots will be available as a resource to the Division of Professional Licensure and BBRS. Please do not hesitate to contact me should you have any questions.

Sincerely,

Thomas Ashley
Vice President, Policy

Anderson, Robert (DPL)

From: Rosenstock, Steven <SRosenstock@eei.org>
Sent: Friday, December 14, 2018 8:58 AM
To: Anderson, Robert (DPL)
Cc: Finlayson, Ian (ENE)
Subject: Support for EV requirements
Attachments: IEI_EEI EV Forecast Report_Nov 2018.pdf

Mr. Anderson,

On behalf of the Edison Electric Institute, I support the EV provisions (new Section C405.9 and the new definitions associated with the new section) that are shown in Proposal Number 12-4-2018.

Attached is a report that was recently released showing the projections of electric vehicle sales across the US through 2030, and the infrastructure needed to support the rise in vehicle sales (shown in Figure 3 on report page 3, file page 5 of 18).

Provisions show in C405.9 will be extremely beneficial for the state, and will reduce the costs of installing the necessary infrastructure.

Thank you for your consideration of my comments.

Sincerely,

Steve Rosenstock, P.E.
Senior Manager, Customer Technical Solutions
701 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2696
202-508-5465
www.eei.org

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The Edison Foundation
INSTITUTE for ELECTRIC INNOVATION

EEI Edison Electric INSTITUTE

Report

Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030

November 2018

Prepared by:
Adam Cooper (IEI) and Kellen Schefter (EEI)

Executive Summary

The transition to electric vehicles (EVs) is well underway with more than 1 million EVs on U.S. roads as of October 2018. Automakers are responding to customer demand and are developing more EV models, including both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs), that are increasingly cost-competitive with internal combustion engines. In addition, customers are purchasing EVs in record numbers, and electric companies are working with stakeholders to move the EV infrastructure market forward.

Electric transportation is a win-win. It meets customer needs, provides environmental benefits, and supports America's energy security.

The future of electric transportation is evolving rapidly. In response, the Edison Electric Institute (EEI) and the Institute for Electric Innovation (IEI) have developed this updated EV sales forecast through 2030 and have estimated the associated charging infrastructure needs.[1] The EEI/IEI forecast is a consensus forecast based on five independent forecasts.

The results show the following:

- The **stock of EVs** (i.e., the number of EVs on the road) is projected to reach **18.7 million in 2030**, up from slightly more than 1 million at the end of 2018 (see Figure 1). This is about 7 percent of the 259 million vehicles (cars and light trucks) expected to be on U.S. roads in 2030.
- It took 8 years to sell 1 million EVs. We project **the next 1 million EVs** will be on the road in less than 3 years—by early 2021.
- **Annual sales of EVs** will exceed 3.5 million vehicles in 2030, reaching more than 20 percent of annual vehicle sales in 2030 (see Figure 2). Compared to our 2017 forecast, EV sales are estimated to be 1.4 million in 2025 versus 1.2 million.[2]
- About **9.6 million charge ports will be required** to support 18.7 million EVs in 2030 (see Figure 3). This represents a significant investment in EV charging infrastructure.

1. The 2018 forecast is an update to: *Plug-in Electric Vehicles Sales Forecast Through 2025 and the Charging Infrastructure Required.* Edison Electric Institute and Institute for Electric Innovation. July 2017. http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf
2. Ibid.

Figure 1. EEI/IEI Forecast of EV Stock in 2030

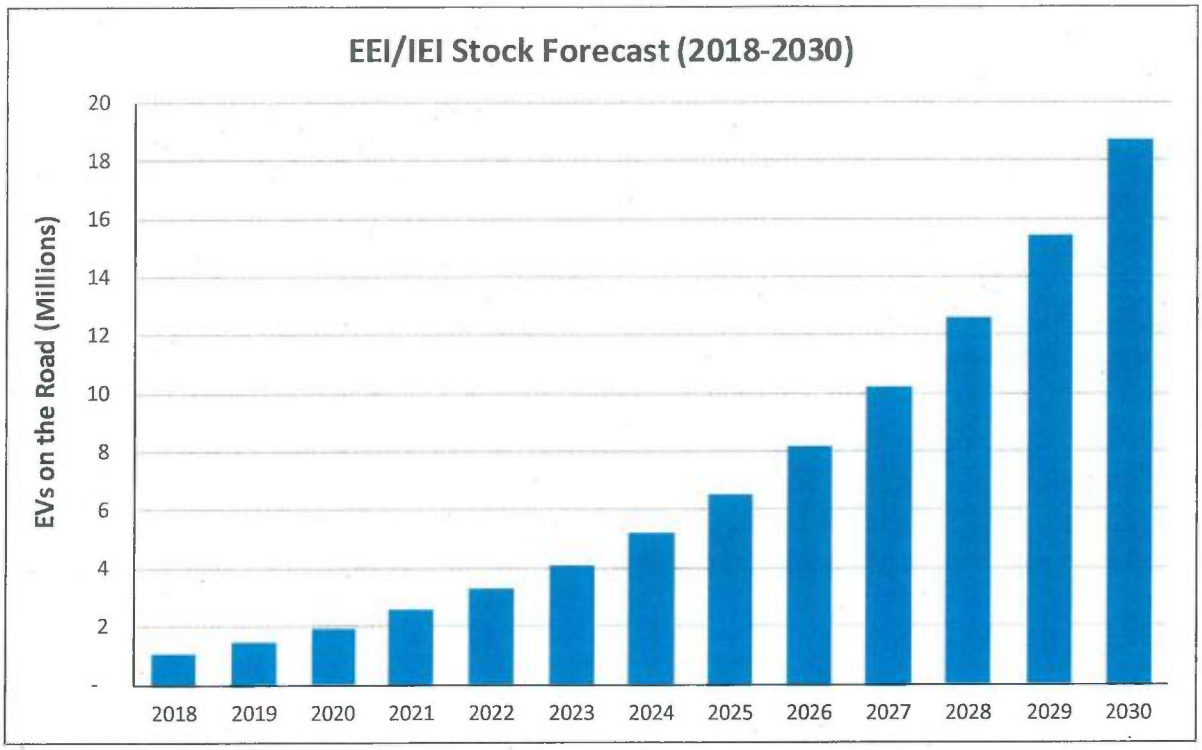


Figure 2. EEI/IEI Annual EV Sales Forecast as Percent of Total Vehicle Sales

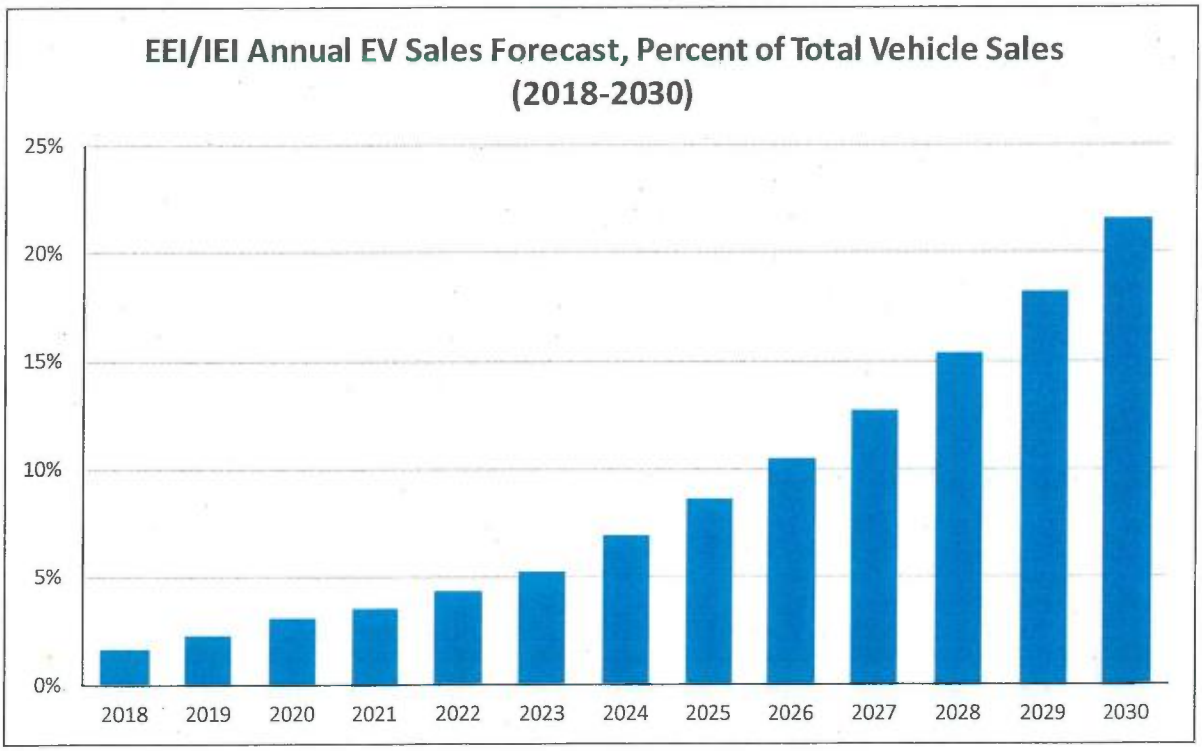
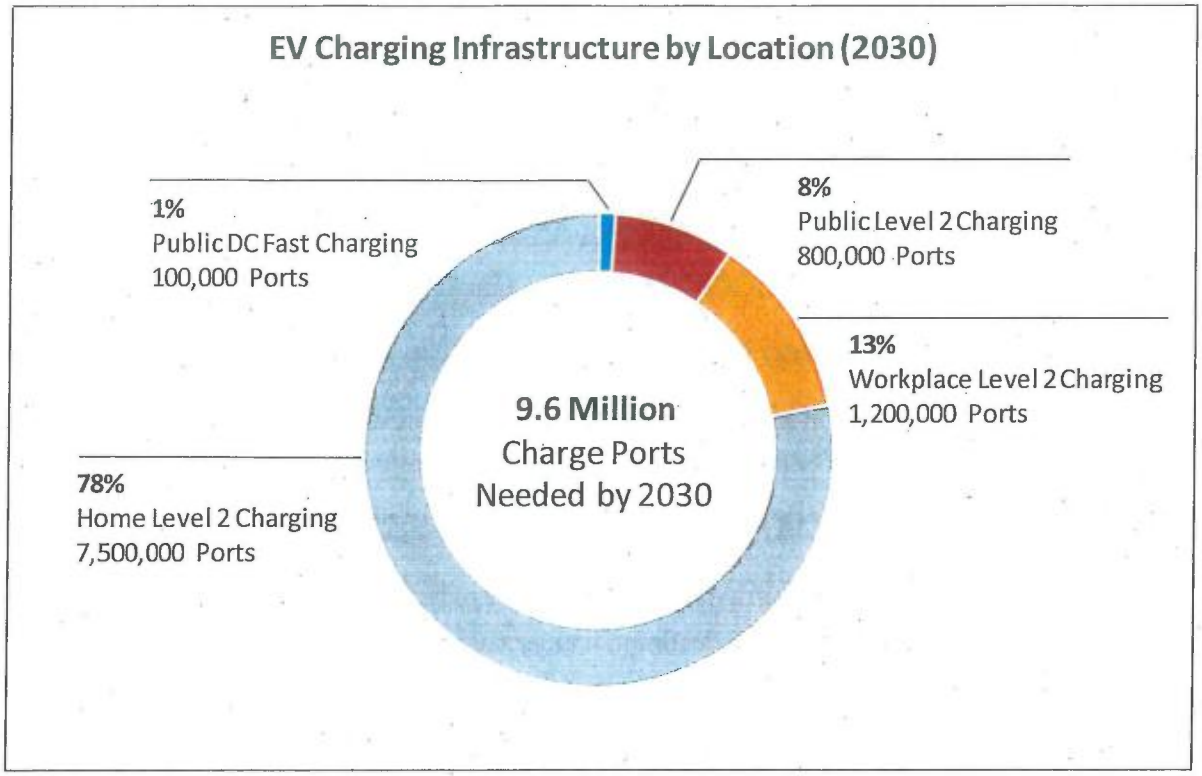


Figure 3. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast



Electric Vehicle Forecast

Approach

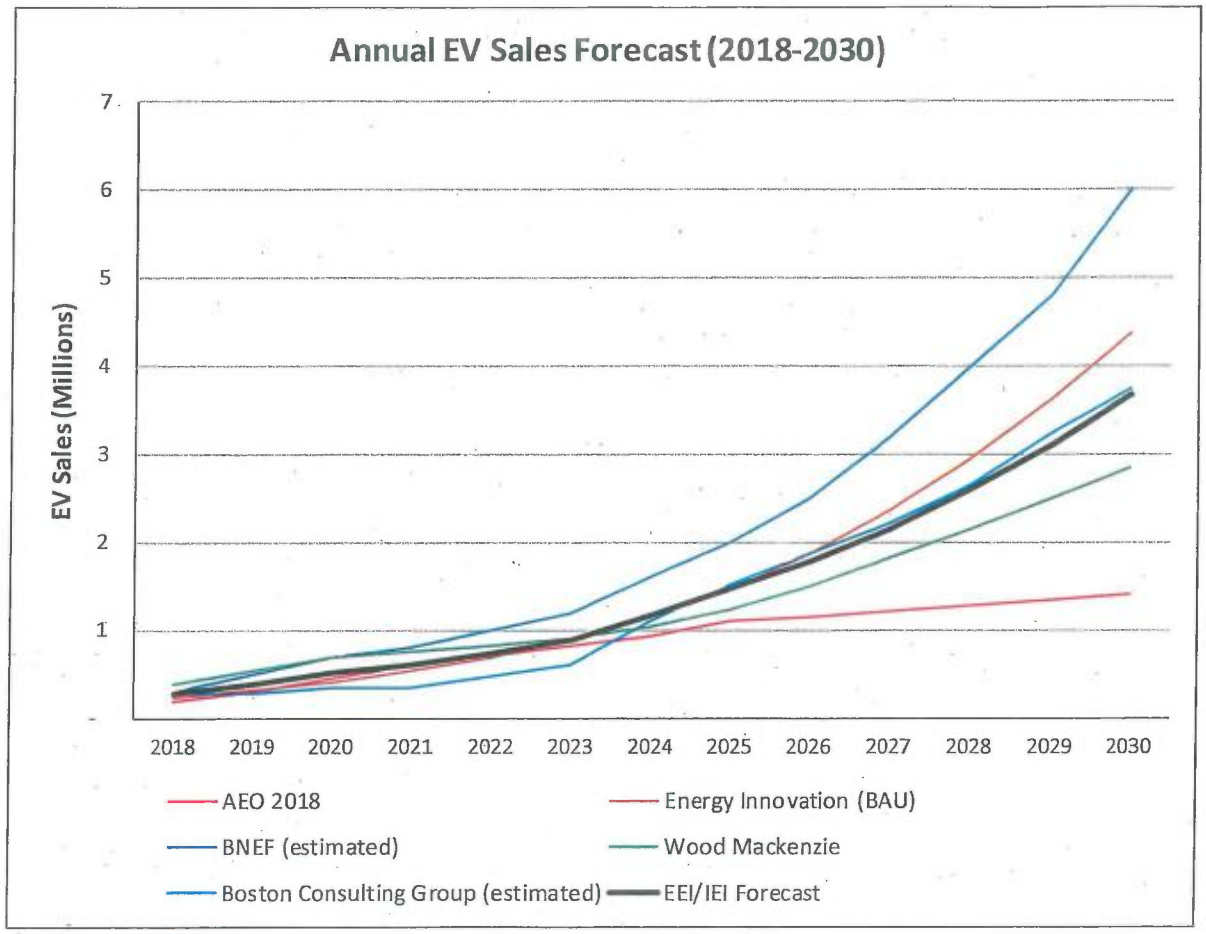
EEI and IEI developed a consensus forecast of EV sales projections from 2018 to 2030 based on five independent forecasts:

- Bloomberg New Energy Finance (BNEF) – Electric Vehicle Outlook 2018 (May 2018).[3]
- Boston Consulting Group (BCG) – The Electric Car Tipping Point (November 2017).[4]
- Energy Innovation – Energy Policy Simulator 1.4.1 (accessed July 2018).[5]
- U.S. Energy Information Administration (EIA) – Annual Energy Outlook 2018 Reference Case (February 2018).[6]
- Wood Mackenzie – The Electric Vehicle Outlook Data (August 2018).[7]

These forecasts were selected because they include three key factors: customer preference models that determine interest in EVs; declining battery costs that influence EV cost competitiveness with internal combustion engine (ICE) vehicles and manufacturer profitability; and fuel efficiency standards and environmental regulations.

3. Electric Vehicle Outlook 2018. Bloomberg New Energy Finance. May 2018. https://www.bloomberg.com/news/articles/2018-05-22/bp-invests-in-tech-to-charge-cars-as-quickly-as-filling gas-tank and https://about.bnef.com/electric-vehicle-outlook/#toc-download
4. The Electric Car Tipping Point. Boston Consulting Group. November 2017. https://www.slideshare.net/TheBostonConsultingGroup/the-electric-car-tipping-point-81666290 and https://www.bcg.com/en-us/publications/2018/electric-car-tipping-point.aspx
5. Energy Policy Simulator. Energy Innovation. July 2018. https://us.energypolicy.solutions/scenarios/home
6. Annual Energy Outlook 2018. U.S. Energy Information Administration. February 2018. https://www.eia.gov/outlooks/aeo/
7. Electric Vehicle Outlook Data. Wood Mackenzie. August 2018.

Figure 4. EEI/IEI Annual EV Sales Forecast Compared to Selected Forecasts



Comparison to Automaker Announcements

Figure 4 shows that EEI/IEI forecasts 3.5 million EV sales in 2030. Comparing the forecasted EV sales to automaker announcements is a useful reality check. Some automakers publicly have announced EV sales targets and plans for future EV models. Based on these announcements, estimates from EV analysts, and our own assumptions, the minimum number of EV sales is around 2.5 million in 2030.[8]

Table 1 shows the actual percent of EV sales in 2017, the percent expected in 2030, and the likely number of EV sales in 2030 projected by manufacturer. Given that many of the manufacturers' announcements are for 2020 or 2025 and that EV sales likely will continue to increase until 2030, we believe the projected forecast for 3.5 million EV sales is reasonable.

8. Individual automaker data was gathered from automaker websites, trade press articles, and public announcements.

Table 1. EV Sales in 2030 Projected by Vehicle Manufacturer

Manufacturer	% EV sales in 2017 (actual)	All vehicle sales expected in U.S. in 2030	% EV sales expected by given year	Estimated EV sales in 2030
BMW	6.0%	360,000	20% (2025)	72,000
General Motors	1.5%	3,000,000	5% (2030)	150,000
Honda	0.1%	1,650,000	15% (2030)	247,500
Mercedes	0.9%	380,000	25% (2025)	95,000
Nissan	0.7%	1,600,000	20% (2020)	320,000
Tesla	100.0%	850,000	100%	850,000
Toyota	0.9%	2,450,000	9% (2030)	220,500
Volkswagen	1.3%	630,000	25% (2025)	157,500
Volvo	3.5%	80,000	50% (2025)	40,000
Subtotal (Automaker Announcements)		11,000,000		2,152,500
Fiat Chrysler	0.5%	2,100,000	5% (2030)	105,000
Ford	0.8%	2,600,000	5% (2030)	130,000
Hyundai-Kia	0.5%	1,300,000	5% (2030)	65,000
Subtotal (Estimated)		6,000,000		300,000
Total		17,000,000	14%	2,452,500

Charging Infrastructure Needed to Support EV Market

The availability of EV charging infrastructure is fundamental to the growth of EVs. Unlike conventional vehicles, which typically refuel only at gasoline stations, EVs may charge at many different locations, such as while parked at home, at work, or in public spaces.

Charging equipment is needed to deliver electricity from the energy grid to an EV. This charging equipment, which often is referred to as a charging station or a charge port, comes in a variety of types and configurations, but is generally categorized by power level:

- **Level 1**: 120-volt, alternating current (AC) power. Level 1 charging refers to charging stations and conventional electric outlets that a driver may plug into via a charging cord set that typically is included with an EV. Level 1 charging adds about 4 miles of electric range per hour of charging.

  For this analysis, we assume that half of all EVs with access to home charging will use Level 1 charging, while the other half will use Level 2. Level 1 charging also may be available at workplaces and public locations, but that is not considered in this analysis.

- **Level 2**: 240-volt, AC power. Level 2 charging stations typically are mounted on a wall or on a pedestal. Level 2 charging at home typically requires the installation of a 240-volt circuit. Level 2 charging adds about 10 to 20 miles of electric range per hour of charging.

For this analysis, we assume that all workplace and public locations use Level 2 charging.

- **DC Fast Charging (DCFC)**: Converts AC electricity to direct current (DC) and delivers charge to the vehicle at high power, typically 50 kilowatts (kW) or greater. DCFC is intended to add a substantial charge to an EV in a short amount of time (e.g., more than 80 miles of range in about 30 minutes of charging, depending on battery size and power level).

  For this analysis, we assume DCFC is used only at public DCFC locations at power levels of 50 to 150 kW and is only available for use by BEVs.

Table 2 summarizes the EV charging infrastructure locations, charging equipment type, and available charging time considered in this analysis. This analysis limits consideration to these major categories for simplicity.

Table 2. EV Charging Equipment by Location

Location	Charging Type Considered	Charge Time
Home (single family homes and multi-family dwellings)	Level 1, Level 2	Overnight (approx. 12 hours)
Workplaces	Level 2	Work day (approx. 8 hours)
Public Level 2	Level 2	Approx. 2+ hours
Public DC Fast Charging	DCFC	Approx. 30 minutes

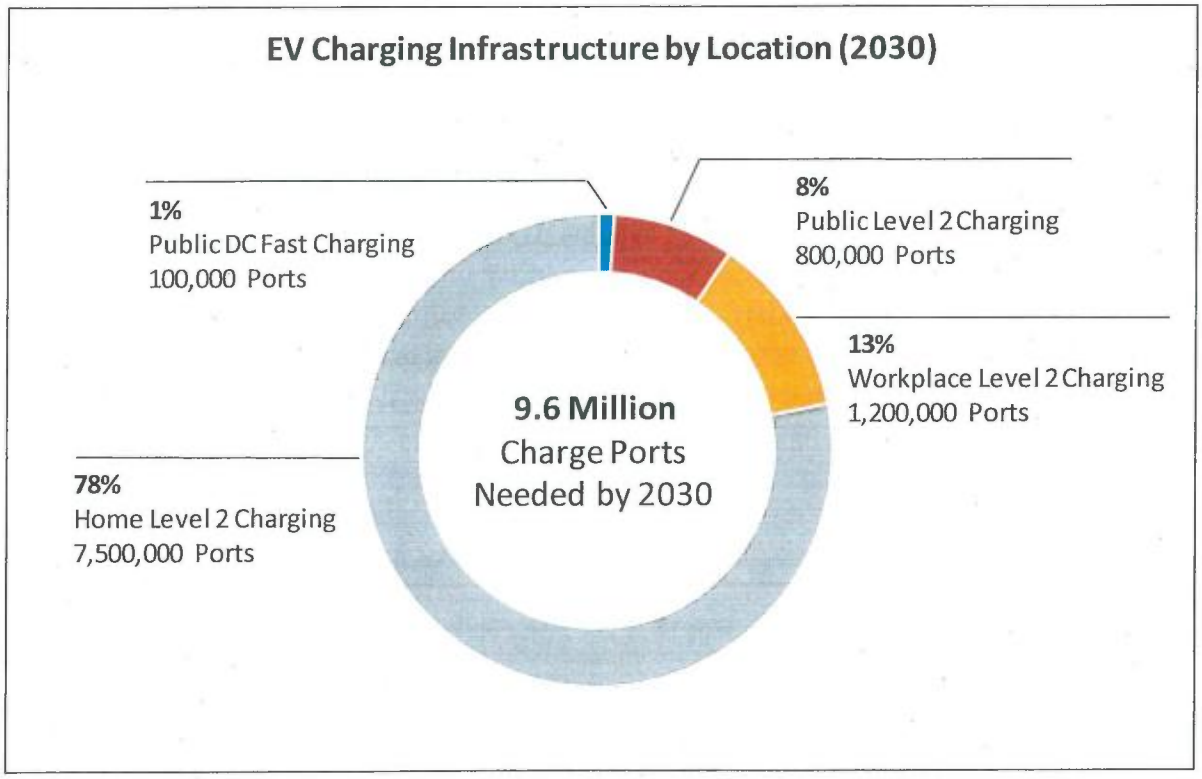
To date, the majority of EV charging occurs at home. However, having charging infrastructure at workplaces or in public settings allows EV owners to drive more miles on electric, enables longer trips, and reduces range anxiety. In addition, public charging infrastructure is important for EV owners who do not have dedicated home charging, such as in multi-family dwellings (e.g., apartment buildings) or those with street parking.

Modeling the Charging Infrastructure Needed to Support EV Growth

EEI and IEI estimated the EV charging infrastructure needed to support the more than 18 million EVs projected to be on the road in 2030 using the Department of Energy's Electric Vehicle Infrastructure Projection (EVI-Pro) Lite tool.[9] The EVI-Pro Lite tool is a simplified, publicly accessible version of a model developed by the National Renewable Energy Lab (NREL) to estimate the demand for EV charging infrastructure. The tool estimates the number of charging ports needed within a city or state to support a given EV population, based on vehicle travel patterns as well as EV and charging station characteristics. The tool allows users to adjust key assumptions, such as the mix of BEVs versus PHEVs and the amount of charging done at home.

Based on the EEI/IEI forecast, we estimate that about 9.6 million charge ports will be needed to support the 18.7 million EVs projected to be on the road in 2030.[10] The mix of charge ports by location is shown in Figure 5.

Figure 5. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast



9. See https://www.afdc.energy.gov/evi-pro-lite (accessed October 2018).
10. This analysis considers only incremental charging ports needed. The home Level 2 charging plugs are incremental because they are assumed to require new charging equipment and installation in a home. An equal amount of Level 1 charging is assumed to be available at home locations (e.g., via conventional outlets) and, therefore, is non- incremental.

Our assumptions include:

- EV Population: The EVI-Pro Lite tool does not provide a national calculation option, so the results shown are the sum of the outputs for individual analyses of all 50 states and the District of Columbia. The 18.7 million EVs were allocated by applying a uniform sales growth rate to each state. Since the tool limits the EV population to no more than 10 percent of all registered vehicles, states that exceeded this market share were capped at 10 percent and the excess vehicles were allocated to the remaining states based on their EV market share. This effectively shifts the EV distribution among the states closer to that of the conventional vehicle population, which is reasonable as EVs become more mainstream.

- Vehicle Mix: The EVI-Pro Lite tool simplifies EV models to four types – PHEVs with electric ranges of 20 and 50 miles and BEVs with electric ranges of 100 and 250 miles. This analysis assumed a split of: 15 percent 20-mile PHEVs; 25 percent 50-mile PHEVs; 15 percent 100-mile BEVs; and 45 percent 250-mile BEVs. While the current EV population is roughly 50-50 split between PHEVs and BEVs, this projected split reflects a 60-40 bias toward BEVs that is estimated based on automaker product announcements. This effectively increases the number of DCFC ports needed, while reducing the number of Level 2 ports.

- Support for PHEVs: The EVI-Pro Lite tool allows users to select "partial" or "full" support for PHEV drivers. The full support option adds Level 2 chargers at workplaces and public locations, such that most PHEV trips can be completed on the electric range only, while the partial support option assumes more PHEV trips will be completed using the gasoline range once the electric range is depleted. This analysis chose the full support option, with the assumption that PHEV drivers will seek to maximize their electric miles and minimize their gasoline miles and that providing the necessary charging infrastructure to do so will be needed to drive adoption to the forecasted level. This assumption effectively increases the number of Level 2 ports.

- Home Charging: The EVI-Pro Lite tool default assumption is that all EV drivers have access to overnight charging at home and begin each day with a full charge. While this assumption may closely approximate the EV population today, this analysis assumes that the forecasted EV buyers will resemble conventional vehicle households more closely. Studies suggest only about 80 percent of households have access to off-street parking, and even fewer have access to a *dedicated* off-street parking space.[11] This analysis assumed 80 percent of the forecasted EV population would have access to home charging, which effectively increases the charging ports needed in other locations. Additionally, this analysis assigned a home Level 2 charging station to half of these EVs with home charging (40 percent of the forecasted EV population), with the assumption that Level 1 charging at home will be available and sufficient for the remaining EVs.

11. Traut, Elizabeth, et al., U.S. Residential Charging Potential for Electric Vehicles, Carnegie Mellon University. https://www.cmu.edu/me/ddl/publications/2013-TRD-Traut-etal-Residential-EV-Charging.pdf .

Approaches to Deploying EV Charging Infrastructure

The EV market is driven by a myriad of dynamics, including customer awareness and acceptance, the types of EVs available and their affordability, and the availability of charging infrastructure. It is well established that the lack of EV charging infrastructure is a primary barrier to EV adoption.[12] The analysis using the EVI-Pro Lite tool in this report estimates the charging infrastructure needed to support a certain level of EVs. In this section, we discuss approaches for deploying EV charging infrastructure.

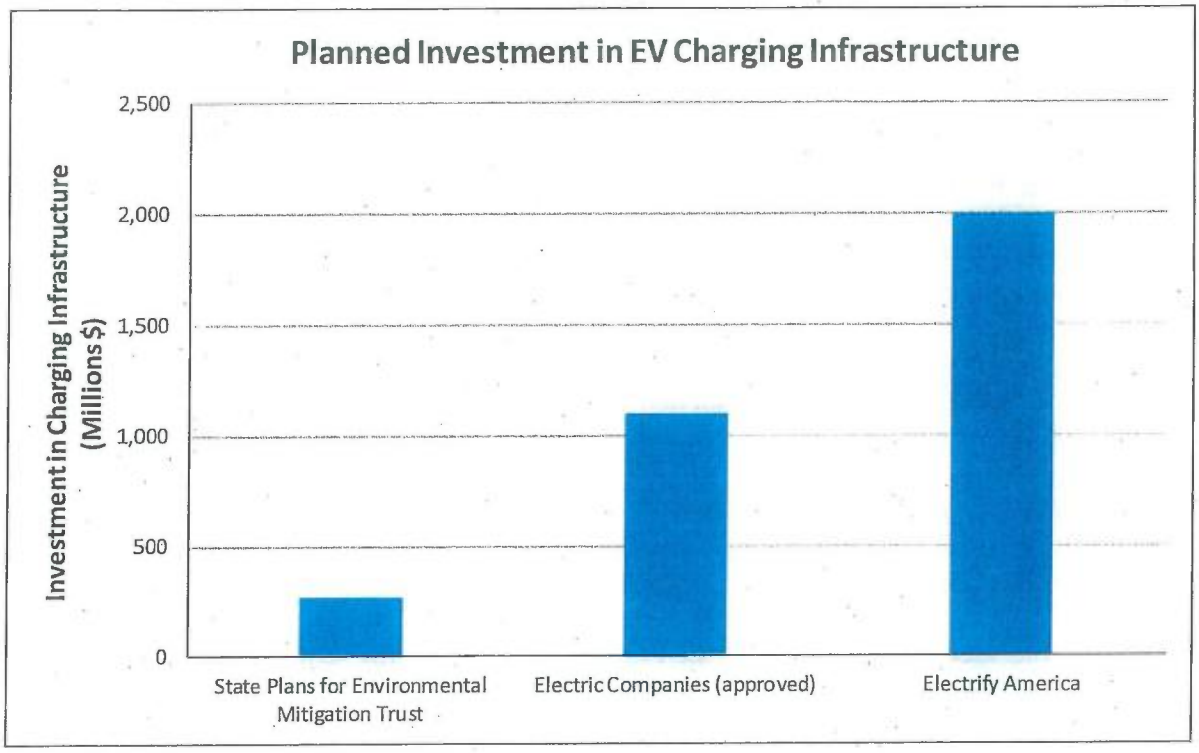
Today, approximately 45,000 public Level 2 charging ports and 9,000 DCFC ports are available, including those dedicated to Tesla vehicles.[13] The precise number of workplace Level 2 charging stations is unknown. Based on the EVI-Pro Lite tool results, as shown in Figure 5, more than 2 million charge ports in workplaces and public locations will be needed by 2030. The significant difference between the current availability of charging infrastructure and the expected charging infrastructure needed suggests a growing "infrastructure gap" that must be addressed.

One of the impediments to widespread charging infrastructure availability is the cost. The costs associated with EV charging infrastructure include the equipment itself, ongoing operation and maintenance costs, and the installation costs needed to get power to the charging station site. These costs can vary widely, from a few hundred dollars to install a Level 2 charger at home to tens of thousands of dollars to install a DCFC.[14] Much of the EV charging infrastructure to date has been paid for by the customer or entity that hosts the charging equipment (the "site host"), whether that is a homeowner, a commercial property owner, or a public entity.

12. NREL, *Consumer Convenience and the Availability of Retail Stations as a Market Barrier for Alternative Fuel Vehicles,* https://www.afdc.energy.gov/uploads/publication/56898.pdf
13. U.S. Department of Energy, Alternative Fuels Data Center. http://www.afdc.energy.gov/fuels/stations_counts.html (Accessed November 2018)
14. U.S. Department of Energy, *Costs Associated With Non-Residential Electric Vehicle Supply Equipment,* https://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf

The EV charging marketplace is evolving, and different approaches to providing the charging infrastructure for the EV market are being deployed. Some of the entities that are investing in charging infrastructure are below and are summarized in Figure 6.

Figure 6. Planned Investment in EV Charging Infrastructure



- State governments: Twenty-four states have some type of incentive (e.g., grant or tax credit) to support the deployment of EV charging stations. The Environmental Mitigation Trust, established in October 2017 under the Volkswagen diesel emissions settlement, will provide states and Indian tribes with $2.925 billion to mitigate emissions of nitrogen oxides (NOx). States may use up to 15 percent of their funds to deploy EV charging infrastructure. So far, 41 states have allocated at least some of their funds to EV charging infrastructure, representing more than $265 million in potential investment.[15]

- Automakers: Tesla has built a "Supercharger" network of about 5,000 DCFC ports at 560 locations in the U.S. dedicated to its vehicles.[16] Other automakers including BMW, General Motors, Nissan, and Volkswagen also have invested in public charging stations in targeted locations, with partners such as ChargePoint and EVgo managing the

15. Atlas EV Hub, https://www.atlasevhub.com/materials/vw-environmental-mitigation-fund-tracking/state-tracking-dashboard/

16. U.S. Department of Energy Alternative Fuels Data Center, http://www.AFDC.energy.gov

stations.[17] Electrify America, a subsidiary of Volkswagen established as part of the diesel emissions settlement, is required to spend $2 billion over 10 years (2017-2027) to deploy charging infrastructure and related activities to support the EV market.[18]

- Electric companies: Electric companies across the country increasingly are gaining state regulatory approval to invest in electric transportation. These investments are primarily in EV charging infrastructure deployment, but also may include charging infrastructure for other applications (such as medium- and heavy-duty trucks and buses), as well as other market support activities such as customer education and outreach. As of September 2018, approved investments totaled more than $1.1 billion.

Electric Company Role

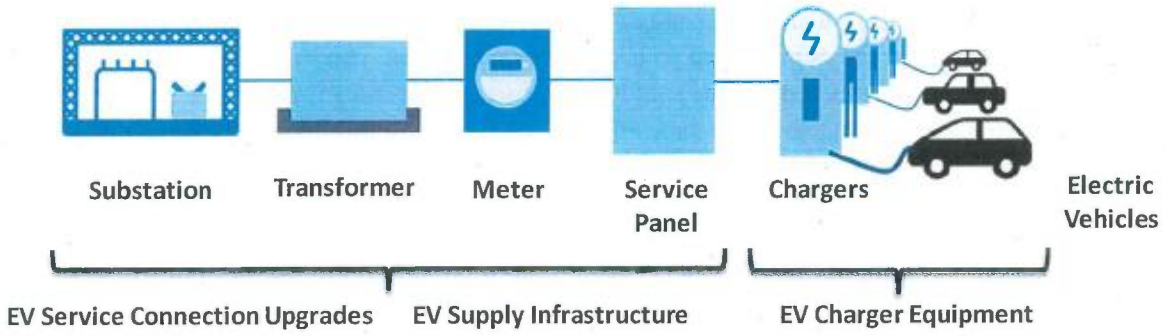
Electric companies are well-positioned to deploy EV charging infrastructure. Electric company investment in charging infrastructure may take many different forms, including:

- Developing "make-ready" infrastructure, which includes service connection upgrades and new supply infrastructure to bring power to the charging equipment (see Figure 7); the site host is responsible for procuring the charging equipment.

- Installing and owning all infrastructure up to, and including, the charging equipment itself; either the electric company, the site host, or a third-party may operate and maintain charging equipment.

- Offering incentives, typically in the form of rebates, to defray some or all of the cost of the charging equipment and/or the installation costs.

Figure 7. Illustration of EV Charging Infrastructure



17. See http://www.autonews.com/article/20180723/MOBILITY/180729957/ev-charging-network-us.
18. See https://www.electrifyamerica.com/our-plan

In addition, electric company investments can support the smart integration of EV charging load into the distribution grid in different ways, including:

- Offering electric rates that encourage EV charging at specific times of the day (e.g., at off-peak times).
- Requiring charging equipment associated with these programs to be ready for managed charging, such as being capable of receiving demand response signals.
- Helping to educate EV drivers and site hosts to choose the appropriate rates and connect them with charging equipment providers.

Policy and Technology Factors to Consider

Federal Policy Issues

Policy developments at the federal level that could impact the U.S. EV market within the timeframe of this forecast include:

- **Vehicle fuel efficiency and GHG standards**: In August 2018, the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) proposed modifications to tailpipe greenhouse gas (GHG) emissions and Corporate Average Fuel Economy (CAFE) standards for light-duty vehicles.[19] The agencies propose to freeze standards for model years 2021-2026 at model year 2020 levels, rather than increasing standards through 2025. The EPA/NHTSA proposal would eliminate California's waiver under the Clean Air Act, including the Zero Emission Vehicle (ZEV) program that requires an increasing number of ZEV sales—primarily EVs—through 2025.
- **Qualified Plug-In Electric Drive Motor Vehicle Credit (IRC 30D)**: Reduces the purchase price of EVs. The credit is structured to phase out for an individual automaker when it sells 200,000 qualifying vehicles. Tesla has exceeded the cap, and General Motors is close behind.

The outcome of the EPA and NHTSA proposal is not determined as of this writing. The EEI/IEI forecast is not driven exclusively by these policies. The other market conditions that are driving EV sales to overperform regulation likely still will be present even if these policies are weakened, but directionally these would have a negative impact on the EV market.

19. See https://www.epa.gov/newsreleases/us-epa-and-dot-propose-fuel-economy-standards-my-2021-2026-vehicles

Battery Costs Trending Down

Declining battery costs and growing customer demand for EVs act as an accelerant to EV sales. Cost reductions in battery packs enable longer-range EVs, increase cost-competitiveness with ICE vehicles, and result in automobile manufacturers producing a wider variety of EVs across more vehicle segments to better meet customer demand.

- Between 2010 and 2017, battery pack costs [$ per kilowatt-hour (kWh)] declined by about 20 percent per year. Bloomberg New Energy Finance estimated battery pack costs in 2017 at $209 per kWh.[20]

- Boston Consulting Group projects that battery pack costs at $100 per kWh will create price parity with ICE vehicles between 2025 and 2030, constituting a 50-percent cost reduction for battery packs from 2017 realized prices.[21]

Effect of Shared-Use Mobility on EV Infrastructure

Along with electrification, the movement toward shared-use mobility is one of the major transformations occurring in the transportation sector. Shared-use vehicles, such as in ride-hailing platforms like Uber and Lyft and carsharing services like Zipcar, Maven, and Car2Go, generally have higher utilization than private-use passenger cars. Expanded adoption of shared-use vehicles likely will have significant impacts on EV charging infrastructure needs, which are not captured by the EV forecast and by the estimated infrastructure needs presented in this paper.

To consider the effects of shared-use mobility, EEI and IEI used an eMobility Infrastructure Model developed by Siemens.[22] This tool was developed to help cities quantify the projected charging infrastructure needed for private EVs, fleets of shared EVs, and electric buses. EEI and IEI adjusted the tool's inputs to approximate the U.S. vehicle population, then compared a baseline scenario where private-use vehicles continue to dominate the market to a scenario where 20 percent of passenger miles are completed with shared-use fleet vehicles.

Major takeaways from this exercise are:

- Highly utilized shared-use fleet vehicles deliver more passenger miles per vehicle than private-use vehicles. The adoption of shared-use fleet vehicles means fewer vehicles overall are needed to deliver the same total passenger miles.

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20. See https://about.bnef.com/blog/tumbling-costs-wind-solar-batteries-squeezing-fossil-fuels/
21. See https://www.bcg.com/en-us/publications/2018/electric-car-tipping-point.aspx
22. Thayne, Julia; Leah Lazer, Dr. Noorie Rajvanshi, and Sarah Barnes. 2018. Shared eMobility Infrastructure Model v.1. Siemens Urban Development.

- Assuming EVs are adopted at the same rate by private drivers and shared-use fleets, reducing the total vehicles on the road also reduces the number of EVs on the road—leading to a lower number of EV charging stations overall.
- While the need for charging stations decreases, the mix of charging station locations and types changes. Shared-use EVs perform more daily driving than private-use EVs and, thus, require proportionally more "opportunity" (i.e., public) charging stations. Additionally, more "depot" charging stations for shared-use fleet EVs will be needed, such as in shared-use parking garages or dedicated charging hubs.

More research is needed to quantify the impacts of shared-use mobility on the need for charging infrastructure, particularly as the various services (rental cars, ride-hailing, carsharing, etc.) evolve over time. Nevertheless, charging infrastructure providers should consider how to accommodate increases in shared mobility.

Conclusion[23]

With more than 18 million EVs anticipated to be on the road in the United States by 2030 and with every EV owner expecting to be able to charge his or her car at home, on the street, at the office, at shopping locations, or along major highways, targeted deployment of charging infrastructure and coordinated collaboration among all stakeholders are required. Electric company participation in the development of EV charging infrastructure supports state-level clean energy and transportation goals, expands customer choice, and helps to scale and ensure the availability of needed EV charging infrastructure to support the growing number of EVs on U.S. roads.

23. EEI and IEI would like to thank and recognize Research Assistants Tisura Gamage and Joel Jaeger who collected data and contributed to the EV sales forecast and charging infrastructure analysis; Eric Wood with NREL for advice on using the EVI-Pro Lite tool; and, Dr. Noorie Rajvanshi and Julia Thayne with Siemens for use of the Shared eMobility Infrastructure Model.

About the Institute for Electric Innovation

The Institute for Electric Innovation focuses on advancing the adoption and application of new technologies that will strengthen and transform the energy grid. IEI's members are the investor-owned electric companies that represent about 70 percent of the U.S. electric power industry. The membership is committed to an affordable, reliable, secure, and clean energy future.

IEI promotes the sharing of information, ideas, and experiences among regulators, policy makers, technology companies, thought leaders, and the electric power industry. IEI also identifies policies that support the business case for the adoption of cost-effective technologies.

IEI is governed by a Management Committee of electric industry Chief Executive Officers. In addition, IEI has a Strategy Committee made up of senior electric industry executives and a select group of technology companies on its Technology Partner Roundtable.

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About the Edison Electric Institute

The Edison Electric Institute (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for about 220 million Americans, and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than 7 million jobs in communities across the United States. In addition to our U.S. members, EEI has more than 65 international electric companies with operations in more than 90 countries, as International Members, and hundreds of industry suppliers and related organizations as Associate Members.

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Anderson, Robert (DPL)

From: Lockwood, Nanette <nanette.lockwood@irco.com>
Sent: Wednesday, December 12, 2018 3:56 PM
To: Anderson, Robert (DPL)
Cc: j.couture@town.sutton.ma.us; Finlayson, Ian (ENE); Ormond, Paul (ENE)
Subject: Proposed modification to MA Stretch Energy Code
Attachments: Ingersoll Rand Comments to MA Stretch Energy Code 12132018.pdf

Attached please find our public comments and proposed modification to the MA Stretch Energy Code.

Please contact me with any questions.

Sincerely,

Nanette

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Nanette.Lockwood@irco.com

December 13, 2018

Mr. John Couture, Chair
Board of Building Regulations & Standards
One Ashburton Place
Room 1301
Boston, MA 02108

Re: Comments on 780 CMR, the MA State Building Code, Chapter 13 and Chapter 115 AA, regarding Thermal Energy Storage

Dear Chairman Couture and Members of the Board of Building Regulations and Standards:

We are pleased to submit the following proposal and comments on the 2019 revisions to the Massachusetts Building Code.

Ingersoll Rand (NYSE:IR) advances the quality of life by creating and sustaining safe, comfortable and efficient environments. Our people and our family of brands - including Club Car, Ingersoll Rand, Thermo King and Trane - work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. Our company is helping to solve some of the world's most pressing challenges including the demand for energy resources and its impact on the environment.

Ingersoll Rand announced in 2014 a roadmap to increase energy efficiency and reduce environmental impact from our operations and product portfolio to result in 20.85 million metric tons of CO_2e avoidance globally by 2020. Ingersoll Rand was an original signatory to the "We Are Still In" declaration confirming our commitment to stand by plans that align with the targets set by the Paris Agreement regarding reducing carbon emissions to avert the worst effects of climate change. As such, we are eager to work with the state of Massachusetts as it seeks to meet its emissions and energy goals.

Ingersoll Rand appreciates Massachusetts' leadership in reducing energy consumption and emissions and we applaud efforts to increase the use of energy storage to improve grid

operations, provide backup power through storms, and benefit the local economy.[1] However, the Ninth Edition of the MA Building Code, Chapter 115 AA Stretch Energy Code unintentionally establishes a disincentive for energy storage technologies such as thermal energy storage. To resolve this issue, Ingersoll Rand proposes the following amendment to either Chapter 13 (Energy Efficiency) or Chapter 115 AA (Stretch Energy Code) in the next edition of the MA Building Code:

(1) Add the following language to Chapter 13, Table G3.1 Section 10:

If the proposed design includes a thermal energy storage system then the baseline design shall use the same equipment, schedules, and setpoints, including required equipment performance corrections, as necessary to operate the thermal energy storage system.

OR

(2) Add a new footnote following Chapter 115 Appendix AA103.2:

If the building includes a thermal energy storage system, then the baseline design in ANSI/ASHRAE/IESNA 90.1-2013 APPENDIX G shall be permitted to use the same equipment, schedules, and setpoints, including required equipment performance corrections, as necessary to operate the thermal energy storage system.

Need and Reason for this proposed code change

The Stretch Energy Code reduces greenhouse gas emissions by reducing overall energy consumption, but due to a more narrow compliance mechanism than ASHRAE Standard 90.1-2013[2], namely "site or source energy," consulting engineers are discouraged from utilizing energy storage technologies such as thermal energy storage (TES). TES, which has the potential to dramatically reduce the peak energy load of a building, increases site energy consumption by 1-3%[3] resulting from the additional use of chilled water system pumps and controls.

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[1] https://www.mass.gov/energy-storage-initiative

[2] AA103.2 Large area and high energy use buildings All buildings over 100,000 sq ft, and new supermarkets, laboratories and conditioned warehouses over 40,000 sq. ft. shall comply with 780 CMR 13 and shall demonstrate energy use per square foot at least 10% below the energy requirements of ANSI/ASHRAE/IESNA 90.1 APPENDIX G Performance Rating Method on either a site or source energy basis.https://www.mass.gov/regulations/780-CMR-chapter-115-aa-stretch-energy-code.

[3] A water-cooled centrifugal chiller plant consumes, on average, about 0.7 kW per ton during peak summer hours. When operating at night, a water-cooled centrifugal ice-making plant has an efficiency of 0.8 kW per ton during ice-making mode. This is a 14.3% increase. In a partial storage configuration, 40% of the total cooling ton-hours are provided by ice. And in an average building, cooling represents 40% of summertime electric consumption. Therefore, the building with ice storage will consume (15% x 40% x 40%), or 2.28% more than a standard building – on a site energy basis.

The use of site or source energy by the Stretch Energy Code essentially ignores the benefits of consuming energy during "off-peak" hours as opposed to "peak" hours; given that daytime peak hours are associated with a higher greenhouse gas (GHG) emissions rate per unit of energy generated and higher energy costs, the potential to reduce both by demand management technologies such as TES are missed in the Stretch Energy Code.

In April 2018, ISO New England published its Electric Generator Air Emissions Report showing hourly marginal CO_2 grid emissions which concluded a 17% GHG reduction per MWh during 11pm to 7 am on weekdays from May to October, 2016 as shown in Table 1 below.[4]

Table 1

Marginal CO2 emissions by hour and month

Marginal CO2 emissions by Hour and Month

	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	Noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm	Midnight
Jan	76.53	79.01	87.11	87.34	84.93	[illegible]	72.40	84.48	80.83	74.52	75.47	77.46	89.40	89.02	79.91	78.59	75.05	72.60	78.70	80.73	80.73	85.71	86.45	[illegible]
Feb	76.31	77.78	75.15	74.61	73.05	67.76	73.83	83.55	82.25	74.09	75.22	80.97	81.18	81.56	76.43	74.91	74.30	73.01	78.99	78.33	82.91	73.38	79.96	72.74
Mar	65.76	66.58	72.12	68.36	59.74	[illegible]	70.81	67.70	[illegible]	77.79	81.50	75.87	75.84	74.04	80.29	80.26	[illegible]	72.36	74.47	69.30	76.64	79.15	75.12	65.81
Apr	70.30	65.28	71.22	67.90	65.10	[illegible]	66.20	64.51	65.98	73.28	70.07	70.62	74.54	72.06	73.53	70.45	75.13	70.37	70.81	75.00	68.31	74.76	73.23	74.02
May	[illegible]	62.35	64.17	[illegible]	[illegible]	[illegible]	67.51	63.90	[illegible]	72.92	62.33	70.06	68.96	64.88	74.42	71.08	67.09	65.66	68.96	69.20	61.77	59.39	73.85	[illegible]
Jun	[illegible]	[illegible]	[illegible]	[illegible]	62.16	[illegible]	[illegible]	72.09	66.78	71.13	74.70	68.91	62.89	64.85	61.76	67.65	69.37	72.09	64.55	64.58	72.81	65.33	80.35	78.45
Jul	67.55	[illegible]	[illegible]	72.13	70.25	66.89	[illegible]	75.63	78.71	79.15	[illegible]	74.73	79.58	77.99	74.87	86.21	76.34	[illegible]	80.82	87.41	81.70	79.43	[illegible]	[illegible]
Aug	76.01	71.66	59.03	69.76	[illegible]	[illegible]	[illegible]	67.77	74.65	74.81	77.76	77.56	76.16	[illegible]	[illegible]	76.43	79.91	[illegible]	77.62	[illegible]	[illegible]	77.82	78.22	[illegible]
Sep	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80.31	75.76	76.31	82.74	76.29	[illegible]	[illegible]	[illegible]	77.71	75.94	79.94	72.68	74.79	76.06	77.42	78.22	[illegible]
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60.30	61.71	63.11	62.65	61.26	62.02	70.75	69.43	74.74	69.55	[illegible]	[illegible]	71.12	75.95	74.06	64.13	[illegible]	[illegible]
Nov	[illegible]	[illegible]	58.95	58.98	[illegible]	[illegible]	60.77	63.03	71.51	77.71	74.27	[illegible]	[illegible]	73.63	[illegible]	[illegible]	[illegible]	[illegible]	67.79	66.87	73.79	71.74	70.71	62.23
Dec	63.85	69.05	64.82	67.94	[illegible]	[illegible]	57.91	60.45	62.27	79.13	69.16	64.61	82.12	74.54	81.19	80.40	[illegible]	68.91	69.42	76.85	80.21	74.67	85.17	72.49

Weekdays only - Marginal CO2 Emissions, peak vs. off-peak

		(12-6a) Off-Peak	(12-6p) On-Peak	Off-peak Discount
Jan-Feb	Winter	67.24	74.71	10.0%
Mar-May, Oct	Spr/Fall	60.01	72.22	16.9%
Jun-Sept	Summer	64.05	75.98	15.7%

2016 New England Electric Generator Air Emissions Report

Benefits and Technical Justification of this proposed code change

This code change proposal does not modify the intent of the Stretch Energy Code. Rather, it will level the playing field for buildings to comply with the Stretch Energy Code and also implement TES, ultimately allowing building owners to reduce energy consumption, costs, and emissions.

TES systems reduce peak demand by working with chilled water systems to minimize the use of high energy consuming HVAC compressors that cool buildings during peak load periods.[5]

TES systems are often used in universities, hospitals, and other institutional occupancies commonly found in Massachusetts, which have centralized chiller plants and a much higher energy consumption rate per square foot than office buildings. TES can thus help Massachusetts increase the use of energy storage to reduce peak demand and overall emissions. Additionally,

[4] 2016 ISO-New England Emissions Report highlighting Charge: 62.7 lbs CO2 per MWh (11pm-7am, weekdays from May-Oct) Discharge: 73.1 lbs per CO2 MWh (10am-6pm, weekdays from May-Oct), https://www.iso-ne.com/event-details?eventId=135210.

[5] http://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/waterside-design/admapn025en_0907.pdf.

TES facilitates LEED certification and general sustainability goals, specifically site and source GHG reductions, and the integration of renewable energy sources.[6]

Building cooling consumes a significant amount of energy during peak times.

Most office buildings are cooled while occupants are present, which contributes to peak demand. In 2012, U.S. buildings consumed 185 billion kWh for cooling.[7] Most of this energy was consumed during daytime hours, Monday through Friday. If this demand was shifted to nighttime hours, the relief to the grid would be substantial.

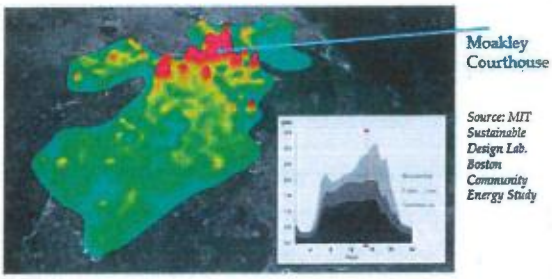
Boston benefits from clean energy technologies like thermal ice storage.

Energy storage, including TES, can reduce peak demand, which in turn can help reduce urban heat island effects. Electrical demand is greater during cooling seasons when the temperature is higher; increased demand also increases the heat island impacts creating a spiraling effect. Reducing energy consumption during the daytime can reduce the heat island effect[8]. The City of Boston has included heat island mitigation in the City's Climate Action plan[9].

The 2016 Boston Community energy study found that clean energy technologies would be most beneficial in downtown Boston where the energy density and peak load consumption is the highest.[10] An example of this can be found at the Moakley Courthouse, where 1 MW of thermal ice storage load reduction is installed.[11] See Figure 1 below.

Figure 1

Moakley Courthouse in Boston – where energy density and peak load consumption are the highest



[6] *Id.*
[7] https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/e5.php.
[8] https://www.tpl.org/sites/default/files/UHI_Tufts_Final%20Report.pdf
[9] https://www.cityofboston.gov/climate/urbanheatislandeffectBoston.asp
[10] Boston Community Energy Study of 2016, co-authored by the Boston Redevelopment Authority, MIT Sustainable Design Lab and MIT Lincoln Laboratory http://www.bostonplans.org/getattachment/d52c36d5-2b1a-40e3-b4cd-3d4fa01ed4e6.
[11] http://www.wbur.org/bostonomix/2016/08/19/moakely-energy-storage

Massachusetts benefits from additional energy storage.

The 2017 Massachusetts State of Charge Report found that additional storage capacity can avoid the costly system inefficiencies from sizing to the highest peak results, thus benefitting ratepayers.[12] The large consumer costs are reflected in the highly variable hourly electricity prices that accounted for as much as $680 million annually from 2013 – 2015 for the 1% most expensive hours.[13] Governor Baker cited energy storage as necessary for Massachusetts to meet its ambitious GHG emissions reduction targets in February 2016.[14] The Report concludes that each dollar spent on energy storage in Massachusetts delivers $1.75-$2.40 in value to ratepayers in the Commonwealth, in addition to the benefits that storage owners receive.[15] Figure 2 illustrates the overall benefits of energy storage to Massachusetts.

Figure 2

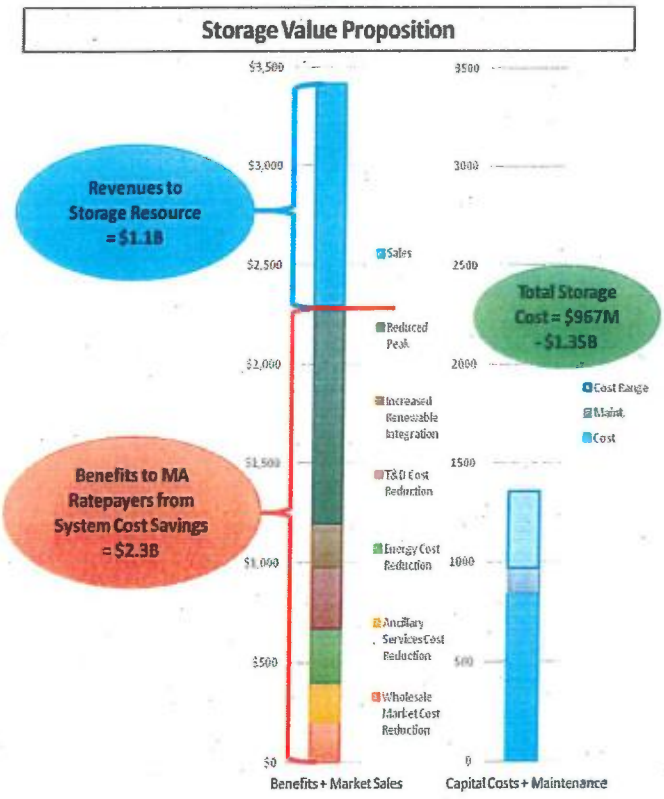


Figure 12: Storage Value Proposition

2017 Massachusetts State of Charge Report

[12] Massachusetts State of Charge Report, written in 2017 by CEC and DOER, https://www.mass.gov/files/2017-07/state-of-charge-report.pdf.

[13] *Id.*

[14] *Id.*

[15] *Id.*

TES will facilitate the implementation of a clean peak standard

Governor Baker signed legislation that focuses on clean energy at times when the grid is most stressed, and typically, most polluting. TES facilitates clean peak by avoiding significant HVAC-related energy consumption from buildings during high peak times.

Cost Impact of this proposed code change

The proposed code change will not change construction costs, as it creates no new requirements for buildings in Massachusetts.

We appreciate the opportunity to provide this proposal and comments on 780 CMR. Please contact me with any questions.

Sincerely,

Nanette Lockwood

Nanette Lockwood
Sr. Director, Policy and Advocacy
Ingersoll Rand

Anderson, Robert (DPL)

From: Lessans, Mark <Mark.Lessans@irco.com>
Sent: Wednesday, December 12, 2018 4:14 PM
To: Anderson, Robert (DPL); j.couture@town.sutton.ma.us
Cc: Finlayson, Ian (ENE); Ormond, Paul (ENE)
Subject: Ingersoll Rand Comments on MA Building Code regarding Dual fuel RTUs
Attachments: Ingersoll Rand Comments to MA Building Code - Dual fuel RTUs 12132018.pdf

Dear Mr. Anderson and Mr. Couture,

Attached please find Ingersoll Rand's proposal and comments on the 2019 edition to the MA Building Code regarding dual fuel rooftop units. Please do not hesitate to contact me if you wish to discuss them.

Best regards,
Mark Lessans

Mark Lessans, CEM
Center for Energy Efficiency & Sustainability
Ingersoll Rand
777 6th St. NW, 11th Floor
Washington, D.C. 20001
+1 240 505 1959 (m)

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800-B Beaty Street
Davidson, NC 28036
Tel (240) 505-1959
Mark.Lessans@irco.com

December 14, 2018

Mr. John Couture, Chair
Board of Building Regulations & Standards
One Ashburton Place
Room 1301
Boston, MA 02108

Re: Comments on 780 CMR, the MA State Building Code, Chapter 13, regarding Dual fuel Rooftop Units

Dear Chairman Couture and Members of the Board of Building Regulations and Standards:

We are pleased to submit the following proposal and comments on the 2019 revisions to the Massachusetts Building Code.

Ingersoll Rand (NYSE:IR) advances the quality of life by creating and sustaining safe, comfortable and efficient environments. Our people and our family of brands - including Club Car, Ingersoll Rand, Thermo King and Trane - work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. Our company is helping to solve some of the world's most pressing challenges including the demand for energy resources and its impact on the environment.

Ingersoll Rand announced in 2014 a roadmap to increase energy efficiency and reduce environmental impact from our operations and product portfolio to result in 20.85 million metric tons of CO_2e avoidance globally by 2020. Ingersoll Rand was an original signatory to the "We Are Still In" declaration confirming our commitment to stand by plans that align with the targets set by the Paris Agreement regarding reducing carbon emissions to avert the worst effects of climate change. As such, we are eager to work with the state of Massachusetts as it seeks to meet its emissions and energy goals.

Ingersoll Rand appreciates Massachusetts' leadership in reducing energy consumption and emissions and we applaud its efforts to improve energy efficiency in buildings by adopting, and making rational strengthening amendments to, model building energy codes. To further bolster

the energy code in Massachusetts, Ingersoll Rand proposes the following amendment to Chapter 13 (Energy Efficiency) in the next edition of the MA Building Code:

Revise Section C406.2 of the 2018 International Energy Conservation Code (IECC), as adopted by reference in Chapter 13 of the MA Building Code, as follows:

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) shall be limited to 10 percent of the total building system capacity.

Exception: *Dual fuel unitary and applied heat pumps* shall meet or exceed the minimum efficiency requirements listed in Table C406.2(1), in addition to the requirements of Section C403.

TABLE C406.2(1)
MINIMUM EFFICIENCY REQUIREMENTS: MORE EFFICIENT HVAC EQUIPMENT PERFORMANCE
DUAL FUEL UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (cooling mode)	< 65,000 Btu/h	Single Package	15.6 SEER 12.8 EER	AHRI 340/360
	≥ 65,000 Btu/h	Single Package	11.5 EER 14.1 IEER	
Air cooled (heating mode, heat pump operation only)	< 65,000 Btu/h (cooling capacity)	47°F db/43°F wb outdoor air	8.8 HSPF	AHRI 340/360
	≥ 65,000 Btu/h (cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP	

Further, add new definition:

Dual fuel unitary and applied heat pumps. Unitary package heat pumps which utilize a warm air furnace, instead of electric resistance heat, when supplemental heating is needed.

Need and Reason for this proposed code change

For mechanical equipment to comply with Section C406.2 of the 2018 IECC, it must exceed by 10 percent the efficiencies listed in Tables C403.3.2(1) through C403.3.2(7), which require that gas-fired commercial warm air furnaces have an efficiency rating of at least 88 AFUE. However, in order for a furnace to meet this efficiency level, it must utilize a condensing technology, and in rooftop applications it is difficult to safely and effectively dispose of furnace condensate. By contrast, residential condensing furnaces typically dispose of condensate through a side wall of a home. As a result, condensing furnaces are niche, non-commercialized products in commercial applications, which severely limits the ability to use a furnace when complying with Section C406.2. The only realistic option for small commercial buildings with

rooftop units is to use heat pumps which meet the efficiency requirements of Section C406.2, but even at these improved performance ratings, it does not make sense to forego the use of warm air furnaces in Massachusetts' cold climates.

The proposed code change will remove this barrier for dual fuel commercial rooftop units – packaged units which contain both a heat pump and a furnace for heating. In these systems, the heat pump is the primary source of heating, but when the outdoor ambient temperature is too low for the heat pump to operate effectively, the compressor disengages, and rather than relying on an electric resistance source, a natural gas furnace provides supplementary heating. This approach allows the rooftop unit to utilize a heat pump when it is efficient to do so, such as during shoulder seasons and mild winter days, and switch to a natural gas furnace at very low outdoor temperatures when the heat pump cannot perform efficiently, if at all. The result is a mechanical system that can be optimized for energy efficiency and lower operating costs, as well as for effective electric demand management without loss of heating utility.

Benefits and Technical Justification of this proposed code change

This proposed code change is necessary to fully enable buildings in Massachusetts to benefit from the optimized utilization of both a heat pump and furnace to provide heating. Dual fuel commercial rooftop units are available from multiple equipment manufacturers in 3-10 ton (36,000-120,000 Btu/h) capacities, and much of the small commercial market segment served by these units uses the prescriptive path to comply with the energy code. This proposed code change increases the heat pump performance requirements beyond 10 percent, as would otherwise be required by C406.2, to make up for the use of a standard efficiency furnace to ensure the intent of this provision is met. As a result, the prescriptive path in Chapter 13 of the Massachusetts Building Code will enable improved HVAC performance while maintaining comfort and cost-effectiveness – the purpose of Section C406.2.

Because this change is part of an optional path, designers will be able to select a system that is optimized for a particular building design in order to maximize the energy-savings benefit. The requirement for additional efficiency measures is intended to provide flexibility in design with optimized costs; including the dual fuel heat pump option brings another technology to the table. It does not replace other options, it simply provides greater opportunity for efficient HVAC system selections – and energy efficiency.

The only reasonable alternative to this code change proposal is to maintain the status quo requirements in Section C406.2 of the IECC, which does little to recognize the energy efficiency benefit of dual fuel rooftop units. As written, C406.2 directs the building designer to select

either a high efficiency heat pump or high efficiency furnace, both of which have their own technical limitations:

- Heat pump coefficient of performance (COP) declines as outdoor ambient temperatures get colder. At very low ambient temperatures, the heat pump compressor will completely disengage, and instead rely on a resistance heating element, which results in a COP < 1.0.
- Furnaces complying with C406.2 must have an annual fuel utilization efficiency (AFUE) ≥ 88, which requires moving to a condensing technology not commercially available in rooftop units.

Dual fuel RTUs solve these limitations by operating in heat pump heating mode when it is efficient to do so, and furnace heating mode when the heat pump cannot run efficiently. In many buildings, this will yield improved source efficiency, significantly lower energy costs, and lower combined emissions when compared to any other practical alternative.

Cost Impact of this proposed code change

The proposed code change will decrease construction costs by providing additional options for equipment to comply with Section C406.2 and allowing the designer to select the optimal solution. It will also decrease utility costs for building owners and occupants by utilizing the most efficient heating source for a given outdoor ambient temperature, and has the potential to decrease utility costs further by enabling more effective demand response during peak electricity periods.

We appreciate the opportunity to provide this proposal and comments on 780 CMR. Please contact me with any questions.

Sincerely,

Mark Lessans
Energy Efficiency Analyst
Ingersoll Rand

Anderson, Robert (DPL)

From: Christina Fisher <cfisher@technet.org>
Sent: Wednesday, December 12, 2018 8:07 PM
To: Anderson, Robert (DPL)
Subject: TechNet EV ready testimony`
Attachments: TechNet MA BBRS EV Ready Codes 12-14-18.pdf

Mr. Anderson-

Attached is testimony from TechNet re: Draft amendments to the Massachusetts State Building Code found at 780 CMR 13.00, 51.00, and 115.00.

Please let me know if you have any questions.

Best,
Christina

--
Christina Fisher
Executive Director, Massachusetts and the Northeast
TechNet.org
Cell: 508-397-4358
Email: cfisher@technet.org

Anderson, Robert (DPL)

From: Tom Hagman <tom.hagman@live.com>
Sent: Wednesday, December 12, 2018 8:45 PM
To: Anderson, Robert (DPL)
Subject: Get EV Ready for Our Future

Dear Chairman Crowley,
As the driver of an electric vehicle, Im writing to support "EV Ready" requirements in the 9th Edition of the Massachusetts State Building Code. Massachusetts must increase access to clean transportation to meet our energy and environmental goals, and residential and commercial buildings are the backbone of EV charging.
Today's buildings need to be ready for tomorrow's clean transportation options. EV Ready requirements are an efficient, affordable and commonsense way to increase access to clean transportation. Adopting an EV Ready requirement is also consistent with Chapter 448 of the Acts of 2016, signed into law by Governor Baker in January.
I urge the Board of Building Regulations and Standards to vote in favor of adopting EV Ready requirements in the 9th Edition of the State Building Code.
Signed,
Tom Hagman

Sent from Mail for Windows 10

Anderson, Robert (DPL)

From: Bijan KHosraviani <DrK@myTotalGreen.com>
Sent: Thursday, December 27, 2018 10:27 AM
To: Anderson, Robert (DPL)
Cc: Finlayson, Ian (ENE); A9 Green
Subject: A9 Green _ 12-27-18 _ N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing.pdf
Attachments: A9 Green _ 12-27-18 _ N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing.pdf

Dear Robert -

Attached please see my comments in relation to the proposed 780 CMR Massachusetts Building Code Amendment/ dated 8/22/2018, Reference: N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing.

Thanks,

--
Bijan KHosraviani
Principal
www.A9Green.com
Save Energy, Save the Earth!
Lexington, MA
781-778-7054 (Main)
408-891-2759(C)
781-345-1121(F)

Please:
1- Send (or cc:) all inquiries to info@A9Green.com
2- Start the subject line of your email with the property address for faster response.
3- Check our Google Review to see what people say about us!

A9 Green / Total Green Energy Solution, LLC
Save Energy, Save the Earth!

December 27, 2018

Board of Building Regulations and Standards (BBRS)
1000 Washington St
Boston, MA 02118

Reference: N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing

Dear John Couture –

I am writing to you state our concern and share thoughts on the proposed 780 CMR Massachusetts Building Code Amendment/ dated 8/22/2018, Reference: N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing.

Although we think it is a very good idea that metal sheet workers do their own bench testing to troubleshoot and be able to produce better work, we believe that their work needs to be trusted but verified by an independent HERS Rater and/or BPI qualified personnel as stated in the current code. We are opposed to this amendment for the following main two reasons:

1. If approved, this can set a precedent for all other inspection and testing aspect of building construction (i.e. electrical, plumbing, structural, insulation, …). For example, soon insulation companies would be asking to do their own inspection and blower door testing, etc.
2. Although we have not done a thorough study on this, we can say during the past 10 years that we have performed the Total duct leakage testing on hundreds of different projects in more than 95 towns and cities in Massachusetts, we think on the first trial only less than 10% of them have passed the 4CFM per 100 sqft threshold as required by code. Of course, this is only based on our limited data. However, if BBRS is seriously considering approving the proposed amendment, we strongly recommend that BBRS should do it is own study and investigation on this subject per status quo before making a decision.

Hope you take our comments in your consideration before making your final decision and please feel free to contact me at any time if there are any questions in this regard.

Sincerely,

Bijan KHosraviani, Ph.D.
Managing Director
A9 Green / Total Green Energy Solution, LLC

Anderson, Robert (DPL)

From: Rosenstock, Steven <SRosenstock@eei.org>
Sent: Friday, December 14, 2018 9:29 AM
To: Anderson, Robert (DPL)
Subject: Table on site to source conversion factors
Attachments: DOE Site Source RFI Final Report 102116.pdf

Mr. Anderson,

In Table C401.2.3, site to source conversion factors, the value for electric power appears to be overstated, as it does not account for the captured energy approach (see the attached report from DOE) for renewable electricity generation.

The estimate should be much lower, especially in light of the state renewable portfolio standards.

Thank you for your consideration of my comment.

Steve Rosenstock, P.E.
Senior Manager, Customer Technical Solutions
701 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2696
202-508-5465
www.eei.org

Follow EEI on Twitter, Facebook, and YouTube.

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U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Accounting Methodology for Source Energy of Non-Combustible Renewable Electricity Generation

October 2016

Acknowledgements

The author would like to thank the following individuals for their thoughtful review, comments, and suggestions in the preparation of this document: Madeline Salzman, Joan Glickman, Cody Taylor, and John Cymbalsky of the U.S. Department of Energy's (DOE's) Building Technologies Office; John Agan of the DOE's Office of Energy Policy and Systems Analysis; Barbara Fichman and Nanda Srinivasan of DOE's Energy Information Administration; Alexandra Sullivan, Cindy Jacobs, and Jean Lupinacci of the U.S. Environmental Protection Agency; and Paul Torcellini of the National Renewable Energy Laboratory.

Author

Paul Donohoo-Vallett, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Strategic Priorities and Impacts Analysis

Intro

As non-combustible sources of renewable power (wind, solar, hydro, and geothermal) do not consume fuel, the "source" (or "primary") energy from these sources cannot be accounted for in the same manner as it is for fossil fuel sources. The methodology chosen for these technologies is important as it affects the perception of the relative size of renewable source energy to fossil energy, affects estimates of source-based building energy use, and overall source energy based metrics such as energy productivity. This memo reviews the methodological choices, outlines implications of each choice, summarizes responses to a request for information on this topic, and presents guiding principles for the U.S. Department of Energy, (DOE) Office of Energy Efficiency and Renewable Energy (EERE) to use to determine where modifying the current renewable source energy accounting method used in EERE products and analyses would be appropriate to address the issues raised above.

Issue

The current *fossil fuel equivalency* approach used in many EERE products and analyses assumes non-combustible renewable electricity (RE) generation has an average heat rate of fossil fuels (9,510 BTU/kWh as of 2015), while an alternate *captured energy* approach uses the heat content of the electricity produced (3,412 BTU/kWh). Neither option is strictly technically more accurate or correct as both are a matter of methodological choice related to particular applications. However, the *fossil fuel equivalency* approach as currently used both within and outside of EERE affects source energy estimates of energy used in buildings and may create inconsistent policy signals as the amount of renewable electricity generation grows. Therefore, the guidelines provided at the end of this document indicate that it can be appropriate for EERE to use the *captured energy* approach in certain applications.

Note that other methodological choices regarding source energy and site-to-source ratio calculations (e.g. geographic resolution of site-to-source ratios, marginal versus average site-to-source ratios, how to account for on-site renewable electricity, nuclear energy and combustible renewable source energy calculations) are not considered here.

Background

Source energy is a concept used to evaluate energy consumption when different types of energy sources need to be accounted for equitably, such as in buildings (e.g. electricity, natural gas, steam, fuel oil) or large sectors of the economy (e.g. coal, natural gas, petroleum).[1] Using source energy allows all of these energy types to be evaluated on a common energy metric. This concept is used in a variety of EERE and related Federal Government products, publications, tools, and reports. Examples are listed below:

EERE products and reports that use source energy:

- Impact Assessments for Appliance Standards
- Market reports (e.g. LEDs)
- Home Energy Score & Asset Score
- Federal Energy Management Program (FEMP) Source Energy Reporting[2]
- Energy efficiency metrics (e.g. Energy Productivity)

Zero Energy Buildings Definition Related Federal Government Products that use source energy:

- ENERGY STAR Portfolio Manager® (EPA)
- Annual Energy Outlook (EIA)
- Monthly Energy Review (EIA)

1 U.S. Environmental Protection Agency, "Energy Star Portfolio Manager Technical Reference – Source Energy." July 2013. Available at: http://go.usa.gov/xjwwT

2 FEMP reports source energy by agency in the Comprehensive Annual Energy Data and Sustainability Performance report, Table T-4: http://go.usa.gov/xZWxQ

3 Energy Information Administration, "Monthly Energy Review." Accessed August 2016. Available at: http://www.eia.gov/totalenergy/data/monthly/

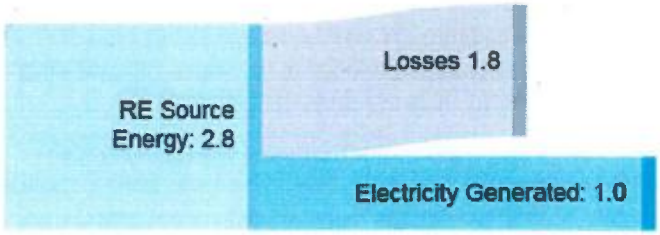
4 Energy Information Administration, "Annual Energy Review 2011", Appendix F: Alternatives of Estimating Energy Consumption, Accessed July 2016. Available at: http://www.eia.gov/totalenergy/data/annual/pdf/sec17.pdf

Most of these examples currently use the *fossil fuel equivalency* approach, and this has been consistent with how Energy Information Administration (EIA) has historically reported source energy using fossil fuel equivalency. However, EIA plans to introduce non-combustible renewable source energy using the *captured energy* in the *Monthly Energy Review*.[3] The details of the two methodologies are outlined below.

It is noted that these are not the complete set of methodological choices possible for non-combustible source energy accounting. Other examples include the incident energy methodology, which would use each technology's efficiency of converting the renewable resource (e.g. wind or solar energy) into electricity to determine source energy,[4] while another method would assume that non-combustible renewable generation consumes no source energy (e.g. 0 BTU/kWh). The request for information (RFI) and research informing this document focuses only on using *captured energy* as an alternative to *fossil fuel equivalence*.

Fossil Fuel Equivalency

This methodology uses the average heat rate of fossil generators and assigns it as the heat rate for non-combustible RE generation – currently 9,510 BTU/kWh, or about 35% efficiency as seen in the figure below. This value represents the source energy value of the fossil generation which is displaced by the RE generation. EIA reported that this methodology was developed in an earlier era when the penetration of RE generation was low, and it was generally displacing the use of fuel oil.[5]



A concern with this approach is that it does not accurately reflect the energy losses associated with different types of energy, as it assumes RE generation has the same energy losses in conversion as fossil generation, and that these losses represent similar economic loss. While RE generators do have losses in converting sunlight or wind energy into electricity, there is no economic value lost because there is no other direct use for the resource that was not captured (e.g. wind or sunlight) as there would be for coal or natural gas that was not combusted. When used for calculated metrics related to determining the efficiency of the power sector and the impact of energy efficiency measures, it introduces distortions due to the fictitious "losses" to the energy system.

Captured Energy

This methodology assumes that the source energy of RE generators is exactly equal to the electricity produced with no energy losses prior to transmission and distribution. This is equal to a heat rate of 3,412 BTU/kWh, or a conversion efficiency of 100%, as shown below.

This approach better shows the economically significant energy transformations in the United States because the "lost" RE energy does not incur any significant economic cost. However, this approach implies that conversion of noncombustible renewable energy is 100% efficient which is not physically true.

3 Energy Information Administration, "Monthly Energy Review." Accessed August 2016. Available at: http://www.eia.gov/totalenergy/data/monthly/

4 Energy Information Administration, "Annual Energy Review 2011", Appendix F: Alternatives of Estimating Energy Consumption, Accessed July 2016. Available at: http://www.eia.gov/totalenergy/data/annual/pdf/sec17.pdf

5 Ibid

Technical Considerations

As mentioned in the introduction, neither option is considered more technically "correct" or more "accurate" than the other, as each option needs to be considered along with its intended use to determine which is appropriate. As discussed by EIA, for their purposes, *fossil fuel equivalency* may be more appropriate when RE generation always displaces fossil fuel generation, and *captured energy* may be more appropriate when RE generation never displaces fossil fuels.[6] There are also additional confounding factors such as Renewable Portfolio Standards and priority dispatch of renewables that would make it extremely challenging to calculate a more representative conversion factor that accurately assesses what fuel source RE generation is displacing.

It is also noted that both methodologies only address the conversion of source energy to electricity generated at the generator. Both methods still need to reflect losses from transmission and distribution when used in a site-to-source ratio as seen in the sample calculation in the appendix.

Impact of Methodological Choice

The choice of methodology makes a difference when used in tools, products, and analyses, and the differences between the methods increase as the penetration of RE generation increases. Table 1 below outlines the quantitative impact on select source energy metrics of switching from the *fossil fuel equivalency* approach to a *captured energy* approach, under projected conditions from EIA's *Annual Energy Outlook 2016* and a hypothetical 50% renewable penetration scenario.

For total source energy, energy productivity, and average site-to-source ratios, increasing RE penetration under *fossil fuel equivalency* has minimal effect by definition as RE source energy has the same heat rate as the fossil fuels used. Instead, fuel switching from coal to natural gas is the primary driver of site-to-source ratio change regardless of RE penetration. As natural gas changes the ratio due largely to higher conversion efficiencies and lower source energy loss, it is inconsistent for the lower economic energy loss associated with RE to not also drive these changes. However, if the *captured energy* approach were instead used, increasing RE penetration causes a further decrease in source energy, an increase in energy productivity, and a decrease in the average site-to-source ratio, beyond the effects of coal to natural gas fuel switching alone.

The analysis shown in Table 1 also shows that the marginal site-to-source ratio would be reduced by ~10% if the *captured energy* methodology was used at current levels of RE penetration. This would likely decrease further in the future as more renewable generation is predicted to come online based on additional factors such as the Clean Power Plan and the tax credit extension which were not included in the modeling scenarios used to evaluate the marginal site-to-source ratio.[7]

The following sections discuss the impact of the methodological choice on specific EERE and other Federal Government programs in more detail.

6 Ibid

7 See note b for Table 1.

Table 1: Projected impact of *fossil fuel equivalency* and *captured energy* methodologies on selected relevant energy metrics, using 2015 data from EIA's *Monthly Energy Review* and future values from EIA's *Annual Energy Outlook 2016*. Note that these values are presented for illustrative purposes only.

Year (RE Generation %)[a]	Fossil Fuel Equivalency	Captured Energy	Impact
Total Economy-Wide Source Energy (Quads)			
2015 (12%)	97.7	94.5	As RE penetration increases, the difference between total economy-wide source energy calculated using *captured energy* and *fossil fuel equivalency* increases
2020 (18%)	100.6	95.9	
2030 (22%)	101.5	95.8	
2040 (26%)	107.2	100.0	
— (50%)	107.4	93.5	
Energy Productivity (GDP 2015 dollar-year$/MMBTU)			
2015 (12%)	$186	$191	Using *captured energy* approach causes RE deployment to increase energy productivity as compared to *fossil fuel equivalency*.
2020 (18%)	$230	$241	
2030 (22%)	$283	$300	
2040 (26%)	$330	$353	
— (50%)	$329	$378	
Average Site-to-Source Ratio			
2015 (12%)	3.00	2.77	RE deployment would cause the site-to-source ratio to decrease in the *captured energy* approach, while the *fossil fuel equivalency* is primarily sensitive to fuel switching from coal to natural gas.
2020 (18%)	2.83	2.49	
2030 (22%)	2.73	2.34	
2040 (26%)	2.71	2.27	
— (50%)	2.72	1.87	
Marginal Site-to-Source Ratio[b]			
2020 (14%)	2.70	2.34	*Captured energy* would decrease the projected source energy savings due electricity energy efficiency measures by ~10% relative to *fossil fuel equivalency*. The difference would increase as RE penetration increased and was more often the marginal generator.
2030 (13%)	2.28	2.10	
2040 (14%)	2.32	2.04	

a The 2015 numbers use data published in the *Monthly Energy Review* [8] and projected future values use data from the *Annual Energy Outlook* (AEO) 2016 reference case.[9] The 50% RE generation scenario uses the generation mix from 2040, but scales generation proportionally so non-combustible renewables accounts for 50% of all electricity generation.

b The marginal site-to-source ratio compares the difference in generation and source energy consumption between the AEO 2014 reference case and the high efficiency technology side case to estimate the marginal impact of reducing demand. AEO 2014 is used as the high-efficiency technology side case for AEO 2016 has not yet been released as of the time of this writing. The renewable penetrations achieved in AEO 2014 are lower than for AEO 2016 due to no Clean Power Plan, higher renewable capital costs, and no renewable tax credit extensions. This approach is similar to one developed by Lawrence Berkeley National Labs and used for assessing the impact of Appliance and Efficiency Standards.[10]

8 Energy Information Administration, "Monthly Energy Review." Accessed August 2016. Available at: http://www.eia.gov/totalenergy/data/monthly/

9 Energy Information Administration, "Annual Energy Outlook 2016." Accessed August 2016. Available at: http://www.eia.gov/forecasts/aeo/tables_ref.cfm

10 Coughlin, K, "Utility Sector Impacts of Reduced Electricity Demand," Lawrence Berkeley National Lab, LBNL-6864E, Accessed July 2016. Available at: http://www.osti.gov/scitech/servlets/purl/1165372

EERE Products and Reports

- **Appliance Standards:** The current methodology uses a marginal full fuel cycle site-to-source ratio to determine the source energy savings for a given unit of site energy reduction in consumption, due to a standard. This is derived from power sector modeling to project the change in power generation mix due to reductions in demand.[11] As shown in the example in the table above for marginal site-to-source ratios, switching to *captured energy* would decrease the total source energy saved due to an electricity-savings measure by ~10% at current levels of RE penetration. The difference between the two methodologies would increase as RE penetration increases as RE would more often be a marginal resource.

  Note that the emissions impacts, electricity consumption savings, and energy cost savings from appliance standards are not affected by the renewable accounting methodology choice. Neither is the assessment on the relative impacts of appliance standards on different electricity generation sources. Only the source energy savings are affected.

- **Energy Efficiency Market Reports:** Market reports, such as *LED Lighting Forecast* published by EERE, project the current and future source energy savings attributed to LED lighting. The *captured energy* approach would decrease current estimates of source energy saved by 7.7% and would continue to decrease as RE penetration increases in the future.

- **Economy-wide Energy Efficiency Metrics:** As seen in the table above, energy efficiency metrics that use source energy are also affected by the methodology choice. For example, energy productivity uses total source energy in the denominator. Under the *fossil fuel equivalency* approach, increasing penetration of RE has minimal effect on energy productivity, while fuel switching from coal to natural gas, or improvements in the heat rate of fossil generators do. Under the *captured energy* approach, increasing the amount of RE generation would also act to increase energy productivity.

- **Building Energy Performance Metrics:** EERE's building energy performance scoring tools — Home Energy Score and Building Asset Score — currently use site-to-source ratios using the fossil fuel equivalency method to estimate the source energy required for a home or building.[12] Changing to the *captured energy* approach would reduce the estimated source energy consumption from electricity use by 7.7%, and this impact would grow in magnitude as RE penetration increased. This would more correctly credit electricity with reduced fuel consumption and associated environmental impacts as RE penetration increases.

- **Zero Energy Buildings (ZEB) Definition**: This definition looks at buildings in terms of the energy flows to and from buildings, and uses site-to-source ratios based on the *fossil fuel equivalency* method to estimate the source energy used for a home or building. Changing to the *captured energy* approach would reduce the estimated source energy consumption from electricity use by 7.7%, and this impact would grow in magnitude as RE penetration increased. This would more correctly credit electricity with reduced environmental impacts as RE penetration increases. The definition calculates on-site renewable generation that is exported to the grid using the *fossil fuel equivalency* approach to properly balance the source energy of grid electricity displaced and allow buildings to achieve net zero status. This could be modified to *captured energy* as well to maintain the appropriate balance with delivered energy.

- **Federal Energy Management Program (FEMP) Reporting:** Since the 1980s, FEMP has been tracking progress toward statutory energy reduction goals in site-delivered energy using the *captured energy* approach for non-renewable energy sources. In general, FEMP reporting uses site-energy metrics, except for *Table T-4: Total Primary (Source) Energy Use in All End-Use Sectors, by Agency published as part of the Comprehensive Annual Energy Data and Sustainability Performance* report,[13] which currently uses *fossil fuel equivalency* for both renewable generation and purchased steam. If captured energy were used instead, the reported source energy use would be reduced by 7.7%, and this impact would grow in magnitude as RE penetration increased.

11 Coughlin, K, "Utility Sector Impacts of Reduced Electricity Demand," Lawrence Berkeley National Lab, LBNL-6864E, Accessed July 2016. Available at: http://www.osti.gov/scitech/servlets/purl/1165372

12 U.S. Department of Energy, "A Common Definition for Zero Energy Buildings," September 2015. Available at: http://go.usa.gov/xiwpH

13 Available at http://go.usa.gov/xZWxQ

Per 42 U.S.C. § 8259(4), when tracking progress toward statutory energy intensity reduction goals, FEMP assumes that on-site renewable generation consumes no captured or source energy (e.g. 0 Btu/kWh). As FEMP uses site-delivered energy as the unit for tracking progress towards energy goals, it also provides a credit to agencies that use combined heat and power plants which bring energy on-site to generate and displace the use of grid-supplied electricity.

Related Federal Government Products and Reports with EERE Equities

- **ENERGY STAR Portfolio Manager® (EPA):** Currently uses site-to-source ratios that use the *fossil fuel equivalency* approach. As shown in the table above, this currently does not capture the displacement of fossil fuel caused by increasing off-site renewable generation. The *captured energy* approach would continue to lower the site-to-source ratio as renewable generation increases.[14]

  EPA's ENERGY STAR Portfolio Manager® calculates on-site renewable generation source energy using the *captured energy* approach.[15] Using the *captured energy* methodology for off-site renewable generation to calculate site-to-source ratios for electricity would treat renewable generation consistently between on-site and off-site generation while still accounting for transmission and distribution losses. EPA has indicated that they plan to transition to the *captured energy* approach for off-site renewable generation in their next update. As indicated above, this will lower a building's total source energy consumption from grid electricity and this impact would increase in magnitude as RE generation increases.

- **EIA Products (Annual Energy Outlook and Monthly Energy Review):** Both of these EIA products employ the *fossil fuel equivalency* approach for reporting historical data and for projecting total source energy into the future, and in all associated products such as the annual energy flow diagram. Use of *captured energy* would show RE generation as a smaller portion of total source energy used in the economy, and would also reduce the reported conversion losses, showing the energy system to be more efficient (i.e. with less losses) as RE penetration increases.

  For projections, the reported total economy-wide source energy consumption is smaller when *captured energy* is used (see Table 1). If not appropriately attributed to fuel-switching, it may appear that the reduction in economy-wide source energy is due to energy efficiency improvements instead of increased RE generation.

  As noted previously, *Monthly Energy Review* will begin reporting both *fossil fuel equivalency* and *captured energy* source energy of RE in future editions.

Additional Impacts and Concerns

- **Stakeholder Confusion:** If the *captured energy* approach replaces *fossil fuel equivalency* in EERE products and metrics then external stakeholders may not fully understand that there are different methodologies behind a metric with the same name, such as site-to-source ratios.

- **Disconnect with Historical Data:** users of products that include a historical series of data and metrics that are impacted by a change in methodology may be burdened when comparing data between before and after the methodology change.

- **Incorrect Impression of Accuracy:** a switch of methodologies may imply that the *captured energy* methodology is more technically accurate than the *fossil fuel equivalency* methodology, whereas, as discussed in the "Technical Considerations" section, the answer is more nuanced.

- **Reduced Perception of Renewable Penetration:** The percentage of source energy for the entire economy provided by renewables is significantly reduced when using *captured energy*, and gives the impression that renewables are not as significant compared to other energy sources. However, reporting of actual electricity generation of renewable sources would be unchanged.

14 U.S. Environmental Protection Agency, "Energy Star Portfolio Manager Technical Reference – Source Energy." July 2013. Available at: http://go.usa.gov/xjwwT

15 U.S. Environmental Protection Agency, "Portfolio Manager and Green Power Tracking." Accessed July 2016. Available at: http://go.usa.gov/xjwfw

Request for Information Response Summary

In response to the request for information (RFI) on this topic,[16] EERE received 7 submissions representing 10 organizations. Responders who agreed to have responses made public were a mixture of electric and natural gas utilities, industry associations, and non-profit organizations (NRDC, NRECA, EEI, APPA, Southern Company, GTI, NPGA, APGA, Laclede Group).[17]

Support of "*captured energy*" methodology: Five responders (NRDC, NRECA, EEI, APPA, Southern Company) fully supported the methodological change of replacing the *fossil fuel equivalency* with the *captured energy* methodology. They noted the changes are needed as the current approach discounts the value of zero emitting renewable resources, and as a result on-site combustion of fossil fuels is valued over off-site generation of renewable resources. They also note that the *fossil fuel equivalency* approach runs counter to DOE energy conservation goals.

Opposition of "*captured energy*" methodology: Two responders (NPGA, Laclede) opposed the methodological change of replacing *fossil fuel equivalency* with *captured energy* methodology. They noted that "*captured energy*" approach does not capture upstream and downstream losses and does not yield an equitable comparison between generation technologies, although this appears to be a misunderstanding of how the change would affect energy accounting for losses.

Neutral comment in support of matching methodology to policy goals: Two responders (GTI, APGA) while neither explicitly supporting or opposing the proposed approach, highlighted the importance of matching the methodology choice with the desired goals or outcomes in order to avoid inappropriately using metrics or leading to perverse incentives. Commenters expressed concern that the proposed approach could be used to promote further electrification.

These commenters noted that the choice used to estimate energy savings from an efficiency measure nationally for accounting purposes would differ from one used to determine the impacts of an energy efficiency measure for a specific building in a specific location for the purposes of making investment decisions. They asserted that the marginal generator displacement methodology is more appropriate for the latter situation. It is noted that the marginal generation displacement methodology is currently used by the appliance standard program when reporting impact assessments.

In addition, four responders (NRDC, NRECA, EEI, APPA) proposed publishing and/or using a fossil-fuel site-source ratio which only includes the source energy from fossil fuel generation, to better match the policy aims of reducing fossil fuel use and greenhouse gas emissions. This would essentially assign no source energy to non-combustible renewable and nuclear energy generation (i.e. 0 BTU/kWh).

Marginal generation emissions factors are most appropriate for individual decisions: Commenters stressed the importance of using regional and marginal emissions factors when determining the impact of specific energy efficiency measures on air pollution. Some also noted that if the *captured energy* approach is used, the marginal factor would underestimate the impact of specific energy efficiency measures on fossil fuel displacement as RE generation is generally not the marginal generator displaced.

Transparency and robustness for values used and calculated and clarity in definitions: Commenters requested that DOE consider creating an annually updated publication which shows all the inputs and calculations used for calculating a site-to-source ratio. (NRDC, NRECA, EEI, APPA) Additional commenters encouraged further transparency and cooperation between DOE and EPA for updating the eGrid regional marginal emission factors. (GTI, APGA)

Support for using full-fuel cycle metrics: Commenters noted that using a full-fuel cycle metric for comparison between fuels is the most equitable methodology, and that the site-to-source ratio only considers source energy consumed at the site of generation and does not account for the embedded "upstream" energy required for mining, processing, and transportation of the fuels in the fuels consumed at the generator. (GTI, APGA, NPGA, Laclede)

16 "Request for Information: Accounting Conventions for Non-Combustible Renewable Energy Use," 81 Federal Register 30, Feb. 15, 2016, pp 7778 – 7779. Available at: http://go.usa.gov/xiw7z

17 Comments available at: http://go.usa.gov/xiwAW

Guidelines on Methodology Choice

As many of the RFI responses noted, it is important to match the methodological choice with the goals of a given policy or metric. After reviewing the impacts of the methodological choices and examining the distorting effect of the *fossil fuel equivalency* methodology in various calculations, the following guiding principles were developed to indicate where it is appropriate to use the *captured energy* methodology.

As noted previously, these guidelines do not address any other aspects regarding source energy or site-to-source ratios (e.g. calculating a site-to-source ratio, marginal versus average site-to-source ratios, accounting for source energy from nuclear and combustible renewable generation, regional versus national accounting, on-site renewable electricity accounting)

1. **Using the *captured energy* methodology when calculating marginal or average site-to-source ratios to calculate source energy savings avoids the fictitious source energy savings and consumption arising from the *fossil fuel equivalency* methodology.** Even though switching to the *captured energy* approach would lower the total amount of projected savings from energy efficiency actions when using the marginal site-to-source ratio, it would be a more accurate assessment of savings and would avoid larger magnitude distortions in the future as RE generation increases both in reality and in modeled projections.

2. **Using the *captured energy* methodology when using site-to-source ratios to score the energy use of buildings provides a policy-consistent signal to building managers that electricity use consumes less source energy as RE generation increases.** This allows more equitable comparisons that better reflect the losses to the energy system associated with different fuel types, including on-site renewables.

3. **Use of the *captured energy* methodology allows increased RE generation to affect derived metrics such as energy productivity.** This approach would allow fuel switching to non-combustible renewable generation to be reflected in metrics such as energy productivity more similarly to fuel switching from coal to natural gas, and better aligned with the economic energy losses of these fuels.

4. **Use of the *captured energy* methodology for off-site renewable electricity generation allows for consistent treatment of conversion to source energy.** For methodologies that account for the source energy of on-site renewable energy production and consumption (i.e. on-site renewable energy is 3,412 BTU/kWh and not 0 BTU/kWh), *captured energy* maintains consistency between the conversion to source energy for on-site and off-site renewable generation.

18 As noted in the *Zero Energy Buildings Definition*, exported on-site RE generation can converted to source energy as if it were grid provided electricity to properly balance out the displaced source energy consumption.

19 See above footnote.

Appendix A: Example Site-to-Source Calculation for 2015

	Generation (GWh)[a]	Conversion (BTU/kWh)[c]		Source Energy (Quads)[d]	
Fossil Fuels					
Coal	1,356,057	10,428		14.14	
Petroleum	28,443	10,814		0.31	
Natural Gas	1,335,068	7,907		10.40	
Other Gases	12,963	—		0.10[e]	
Other Non-Fossil					
Nuclear	797,178	10,459		8.34	
Other	13,239[b]	—		0.19[e]	
Combustible RE					
Wood	42,358	—		0.42[e]	
Waste	21,833	—		0.30[e]	
Non-Combustible RE		**Fossil Fuel Equivalency**	**Captured Energy**	**Fossil Fuel Equivalency**	**Captured Energy**
Hydropower	251,168	9,510	3,412	2.39	0.86
Wind	190,927	9,510	3,412	0.16	0.06
Solar	26,473	9,510	3,412	1.82	0.65
Geothermal	16,767	9,510	3,412	0.25	0.09
			Total Source:	**38.82**	**35.86**

Net Generation of Electricity	4,087,381[f]	3,412	13.95
T&D Losses & Unaccounted	290,564[f]	3,412	0.99
		Total Domestic Generation for End Use:	**12.95**

	Fossil Fuel Equivalency	**Captured Energy**
Site to Source Ratio:	**3.00**	**2.77**

Data Sources:

a *EIA Monthly Energy Review* (MER) Table 7.2a; b *EIA Electric Power Monthly* Table 1.1; c EIA MER Table A6; d Calculated unless otherwise noted; e EIA MER Table 7.3a; f EIA MER Table 7.1; Note that this methodology includes generation from all sectors, and excludes fuel consumption used for useful heat output at CHP facilities. This table is presented as an illustrative example only.

U.S. DEPARTMENT OF
ENERGY
Energy Efficiency &
Renewable Energy

For more information, visit: energy.gov/eere

DOE/EE-1488 • October 2016

Anderson, Robert (DPL)

From: Knowles, Jacob <jknowles@brplusa.com>
Sent: Tuesday, December 18, 2018 12:01 PM
To: Anderson, Robert (DPL)
Cc: j.couture@town.sutton.ma.us
Subject: Public Comment on IECC-2018 and MA amendments

Hi Robert Anderson,

Is it too late to comment on the adoption of IECC-2018 and MA amendments?

If not, please consider the following:

BR+A is a 350-person MEPFP engineering firm, headquartered in Boston Massachusetts. We have witnessed tremendous positive impact of adoption of each successive version of the IECC, ASHRAE 90.1, and the Stretch Code in Massachusetts. The positive impact has included: long-term financial benefits to our clients (due to more efficient building operation), improved quality of the engineering practice to ensure efficiency requirements are incorporated into building designs, reduced demand on utility infrastructure than would be the case with less efficient buildings, reduced carbon footprint of buildings in operation, and the social benefit of making Massachusetts the center of building industry expertise which grows our businesses and allows us to hire staff and export our services to other areas on the United States. Therefore, we support adoption of IECC 2018, ASHRAE 90.1-2016 and the next iteration of the Stretch Code. We strongly support adoption of the most stringent energy code possible. It is critical to the future of our business, the Massachusetts economy, and the environment.

We also recommend that an alternative compliance metric be adopted: greenhouse gas emissions. Currently, stretch code compliance can be determined based on site or source energy. But, one of the major goals of the energy code is to reduce carbon footprint. Therefore, greenhouse gas emissions should be allowed as the metric to compare baseline versus proposed design performance.

In addition, we know that energy storage is critical to the de-carbonization of the electric grid, reduced energy costs, and reduced demand on the electric grid infrastructure. Reliance on the metrics of site energy and source energy (when source energy is calculated based on annual average site to source electric grid conversion factors) results in a penalty for energy storage systems when calculating Stretch Code compliance. This is due to the fact that energy storage systems always have a certain percent of conversion and storage losses. Due to these losses, the result of incorporating energy storage systems into a building design is an increase in the site and average annual source energy. But, the reality is that the storage systems are critical for shifting the peak electric grid loads away from high carbon emissions peak hours, toward low carbon emissions off-peak hours.

One storage technology currently penalized by the reliance on site energy and source energy (using average annual site to source conversion factors) is ice storage. Ideally, projects would be allowed to calculate site energy to source energy conversion factors (or site energy to greenhouse gas conversion factors) based on a more fine-tuned set of parameters (such as on-peak versus off-peak timeframes). If this is not possible within the current political climate, a simpler solution is outlined below that at least prevents penalizing thermal storage systems.

Addition to 90.1-2013 Table G3.1 Section 10:
If the *proposed design* includes a thermal energy storage system then the *baseline design* shall use the same equipment, schedules, and setpoints, including required equipment performance corrections, as necessary to operate the thermal energy storage system.

and

Footnote after AA103.2 in the Stretch Code:
If the building includes a thermal energy storage system, then the *baseline design* in ANSI/ASHRAE/IESNA 90.1-2013 APPENDIX G shall be permitted to use the same equipment, schedules, and setpoints, including required equipment performance corrections, as necessary to operate the thermal energy storage system.

We hope that you will consider these comments as you complete the process of adopting the energy code updates.

Regards,
Jacob

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RESPONSIVE BUILDINGS. RESPONSIVE PEOPLE.

Anderson, Robert (DPL)

From: Christina Fisher <cfisher@technet.org>
Sent: Wednesday, December 12, 2018 8:07 PM
To: Anderson, Robert (DPL)
Subject: TechNet EV ready testimony`
Attachments: TechNet MA BBRS EV Ready Codes 12-14-18.pdf

Mr. Anderson-

Attached is testimony from TechNet re: Draft amendments to the Massachusetts State Building Code found at 780 CMR 13.00, 51.00, and 115.00.

Please let me know if you have any questions.

Best,
Christina

--
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December 14, 2018

Charles Borstel, Commissioner
Division of Professional Licensure
1 Ashburton Place, Rm. 1301
Boston, MA 02108

John Couture, Chair
Board of Building Regulations & Standards
1000 Washington St, Suite 710
Boston, MA 02118

Re: Draft amendments to the Massachusetts State Building Code found at 780 CMR 13.00, 51.00, and 115.00.

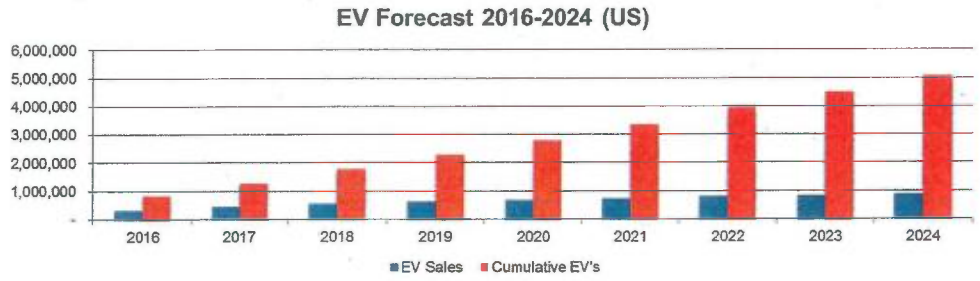
Dear Commissioner Borstel and Chair Couture:

TechNet (www.technet.org) is the national, bipartisan network of over 70 technology companies that promotes the growth of the innovation economy by advocating a targeted policy agenda at the federal and 50 state level. TechNet's diverse membership includes dynamic startups to the most iconic companies on the planet and represents more than two million employees in the fields of information technology, e-commerce, clean energy, telecommunications, gig economy, sharing economy, venture capital, and finance. TechNet is committed to advancing the public policies and private sector initiatives that make the U.S. the most innovative country in the world.

TechNet strongly supports the addition of EV Ready requirements to the Massachusetts State Building code, and I wanted to provide you with some key facts about the value of and cost savings associated with EV Ready building codes.

One way Massachusetts can continue to improve its standing with the next generation of innovative companies is to make sure its commercial and residential buildings are built for the future. Our member companies host tens of thousands of networked charging stations across the country. We believe that access to EV charging is a core function of the buildings in which our member companies operate, from supporting electrified fleet operations to facilitating the valuable employee benefit of EV charging.

EV adoption is on the rise. Since 2013, the cumulative sales of EVs has increased by 445% to over 416,000 on the road today. Navigant Research forecasts that there will be over 5 million EVs in the US by 2024, and the Commonwealth has already committed to seeing at least 300,000 zero emissions vehicles on Massachusetts roads by 2025.



Source: Navigant Research

Paradigm shift in vehicle refueling. EVs have an inherently different refueling model in which drivers refuel when they arrive at, not when on their way to, a destination. According to the Idaho National Laboratory, almost all EV charging takes place at either home (61%) or work (36%) so it is essential that homes and workplaces be equipped to support an increase in EV adoption.

Reduces building costs. Installing EV charging stations in EV Ready buildings can be 85% less expensive than in retrofit scenarios. Ensuring that tenants can scale up EV infrastructure will require fewer retrofit installations over the life of the building, which will ultimately reduce costs as EV adoption increases.

Suggested amendments. Before the Board to adopts the proposed EV Ready requirements, we respectfully request a series of amendments to the draft language:

Residential Building Code.[1] It would be inappropriate to specify the circuit termination for an EV Ready circuit. Requiring certain termination points for circuits would increase the cost of EV Ready requirement for developers and could increase costs for consumers that want to install EV charging stations. We also recommend that the amperage requirement be increased to 60A in order to future-proof buildings for increasing EV charging capabilities.

~~*EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.*~~

In accordance with 527 CMR and this section, the identified number of spaces at the identified in C405.9.3 shall provide sufficient electrical capacity and physical capacity at the service panel to accommodate future simultaneous vehicle charging. Calculated spaces shall be rounded up to the nearest whole number. A minimum 60-ampere branch circuit shall be installed to terminate in close proximity to each proposed locations of future installation of Society of Automotive Engineers (SAE) standard J1772-approved Level 2 electric vehicle service equipment. The circuits shall have no other outlets. A permanent and visible label stating "EV READY" shall

[1] Chapter 13, p. 4

be posted in a conspicuous place at both the service panel and the circuit termination point. The location and number of "EV READY" parking spaces shall be identified on construction documents.

Non-Residential[2]. For similar reasons, the BBRS should strike language that would mandate a specific termination point for a branch circuit.

~~*"EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2). The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector."*~~

In accordance with 527 CMR and this section, the number of EV Ready spaces provided in accordance with Table N1104.2 (R404.2) shall provide a 40-ampere branch circuit to accommodate a future dedicated Society of Automotive Engineers (SAE) standard J1772-approved Level 2 EVSE. The circuits shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Exceptions to the EV Ready Requirement. Several exceptions to EV Ready requirements in the building code present significant concern and should be struck entirely.

- *Parking separated by right-of-way.*[3] This broad exemption from EV Ready requirements for any building with parking that is not onsite. This would defeat the purpose of an EV Ready requirement and make it harder for multifamily residents, workplace, and commercial tenantsto take advantage of transportation electrification.

~~*2. This requirement will be considered met if all spaces which are not EV Ready are separated from the meter by a public right-of-way.*~~

- *Distance from Panel and Separation by Right of Way.*[4] Similarly, the BBRS should strike these overly-broad exceptions that are in conflict with the purpose of an EV Ready requirement.

~~*2. This requirement will be considered met if all spaces which are not EV Ready:*~~
~~*a. Are located more than 130 ft from the nearest electrical panel or sub-panel location, or*~~
~~*b. Are separated from the premises by a public right-of-way.*~~

Shorter-term Parking.[5] This overly-broad exemption would exclude parking spaces "limited to parking durations of less than an hour." This would be inappropriate because (1) decisions about

[2] Chapter 51, p. 4
[3] Chapter 13, P. 4
[4] Chapter 51, p. 4

final use of parking spaces are not typically made by developers and (2) there are many appropriate use-cases for EV charging at short-term parking. ~~*"3. Parking spaces which are limited to parking durations of less than an hour."*~~

Thank you in advance for your consideration on these matters. Please do no hesitate to reach out with any questions.

Sincerely,

/s/

Christina Fisher
Executive Director, Northeast
TechNet
cfisher@technet.org
508-397-4358

[5] Chapter 13, P. 4

Anderson, Robert (DPL)

From: Steinberg, Sarah (HOU) <sarah.steinberg@mahouse.gov>
Sent: Thursday, December 13, 2018 1:24 PM
To: Anderson, Robert (DPL)
Subject: EV-ready wiring provisions letter of support
Attachments: Hecht EV-ready wiring letter of support.pdf

Dear Mr. Anderson,

Please see the attached letter in support of the "EV-ready" wiring provision for new construction amendment to the International Building Codes from Representative Hecht.

Thank you for your consideration,
Sarah

Sarah Steinberg
Legislative Aide
Office of State Representative Jonathan Hecht
29th Middlesex District
State House Room 22
617-722-2140 x7758

Commonwealth of Massachusetts

HOUSE OF REPRESENTATIVES
STATE HOUSE, ROOM 22, BOSTON, MA 02133-1054

JONATHAN HECHT
REPRESENTATIVE
29TH MIDDLESEX DISTRICT
WATERTOWN • CAMBRIDGE

Committees:
Children, Families & Persons with Disabilities
Election Laws
Global Warming and Climate Change
Public Health

TEL: (617) 722-2140 • FAX: (617) 722-2339
Jonathan.Hecht@mahouse.gov

December 13, 2018

Mr. Richard P. Crowley, Chair
Board of Building Regulations and Standards

Dear Mr. Crowley,

I write to express my strong support for including "EV-ready" wiring for new construction in the State Building Code.

The proposed EV-ready wiring provision is critical to the future of EVs (Electric Vehicles) in Massachusetts and, per Chapter 448 of the Acts of 2016, well within the Board's authority to adopt.

As documented in the Massachusetts Comprehensive Energy Plan (released just yesterday), achieving widespread electrification of the transportation sector is critical to reducing the state's reliance on fossil fuels and meeting our legal obligations under the Global Warming Solutions Act. To this end, the Commonwealth in 2014 committed to the goal of having 300,000 EVs on our roads by 2025. This commitment has been reaffirmed by the Baker Administration and by the Legislature with the passage of Chapter 448 of the Acts of 2016 (An Act Promoting Zero Emission Vehicle Adoption).

One current barrier to greater EV adoption is the cost of installing EV charging stations. The proposed EV-ready wiring provision is a practical and affordable solution to this problem. For a typical residential property, EV-ready wiring adds no more than $300 to new construction costs per EV parking spot, but saves an average of $3,500 in avoided retrofit costs when a charging station is installed. For commercial construction, EV-ready wiring adds an estimated $1,650 per EV parking space, but can save up to $7,000 on the cost of installing each charging station.

The substantial cost savings that result from EV-ready wiring have led a diverse set of jurisdictions including California, Hawaii, Washington State, Denver, and New York City to adopt building code provisions similar to the one currently before the Board.

The EV-ready wiring provision will make charging station installation a significantly more affordable choice for Massachusetts residents and businesses, speed the adoption of EVs statewide, and help the state meet its Global Warming Solutions Act obligations, all at a minimal upfront cost.

I urge the Board to adopt it.

Sincerely,

Jonathan Hecht
State Representative
29th Middlesex

Anderson, Robert (DPL)

From: Tom Hagman <tom.hagman@live.com>
Sent: Wednesday, December 12, 2018 8:45 PM
To: Anderson, Robert (DPL)
Subject: Get EV Ready for Our Future

Dear Chairman Crowley,
As the driver of an electric vehicle, Im writing to support "EV Ready" requirements in the 9th Edition of the Massachusetts State Building Code. Massachusetts must increase access to clean transportation to meet our energy and environmental goals, and residential and commercial buildings are the backbone of EV charging.
Today's buildings need to be ready for tomorrow's clean transportation options. EV Ready requirements are an efficient, affordable and commonsense way to increase access to clean transportation. Adopting an EV Ready requirement is also consistent with Chapter 448 of the Acts of 2016, signed into law by Governor Baker in January.
I urge the Board of Building Regulations and Standards to vote in favor of adopting EV Ready requirements in the 9th Edition of the State Building Code.
Signed,
Tom Hagman

Sent from **Mail** for Windows 10

Anderson, Robert (DPL)

From: Alistair Pim <apim@necec.org>
Sent: Friday, December 14, 2018 4:03 PM
To: Anderson, Robert (DPL)
Cc: Peter Rothstein; Janet Besser; Jamie Dickerson
Subject: NECEC Comments for for BBRS in support of EV-Ready Provisions
Attachments: NECEC Comments to BBRS 14Dec2018 FINAL.pdf

Dear Mr Anderson
We appreciate the opportunity to provide the Board of Building Regulations & Standards with comments on the proposed EV Ready requirements included in the amendments to Chapters 13 and 51. NECEC strongly supports including EV Ready language requirements in Massachusetts State building Code.
Please find attached our written comments on behalf of members of our Clean Transportation Working Group, which include several EV Charging companies.
Sincerely
Alistair Pim

Alistair Pim
Vice President, Innovation & Partnerships, NECEC
NECEC – *Your Partner in the Clean Energy Economy*
Northeast Clean Energy Council & NECEC Institute
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apim@necec.org
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Follow NECEC: Blog, Twitter and LinkedIN

Anderson, Robert (DPL)

From: Amy Laura Cahn <alcahn@clf.org>
Sent: Friday, December 07, 2018 4:08 PM
To: Anderson, Robert (DPL); Anderson, Robert (DPL)
Cc: Benevides, Linda (EEA); Deanna Moran; Emily Green
Subject: EV-Ready Building Code
Attachments: CLF Comments on building code amendment (12.7.2018).pdf

Please accept CLF's attached Comments on Proposed Amendments to the State Building Code (780 CMR) to Reconsider EV Charging Stations for consideration at the December 11th public hearing.

Many thanks,

Amy Laura Cahn
Senior Attorney
Interim Director
Healthy Communities &
Environmental Justice
Conservation Law Foundation

62 Summer Street
Boston, MA 02110

P: 617-850-1730
E: alcahn@clf.org

For a thriving New England

clf
conservation law foundation

For a thriving New England

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F: 617.350.4030
www.clf.org

December 7, 2018

The Commonwealth of Massachusetts
Office of Public Safety and Inspections
One Ashburton Place, Room 1301
Boston, MA 02108
ATTN: Robert Anderson

Via electronic mail: *robert.anderson@state.ma.us*

RE: **Comments on Proposed Amendments to the State Building Code (780 CMR) to Reconsider EV Charging Stations**

Dear Mr. Anderson:

On behalf of the Conservation Law Foundation, I thank you for the opportunity to comment on the above-referenced proposed amendment to the State Building Code (780 CMR), the Proposed Amendment to Reconsider EV Charging Stations ("EV-Ready Proposal"), which is currently under consideration by the State Board of Building Regulations and Standards (the "Board").

Conservation Law Foundation strongly supports building code amendments designed to facilitate electric vehicle ("EV") charging by ensuring that new residential and commercial buildings in Massachusetts are "EV ready" with sufficient circuitry and panel capacity to accommodate the future installation of EV-charging equipment. Updating the state building code to accommodate EV charging is key to achieving Massachusetts' goal of deploying over 300,000 EVs by 2025.[1] EV readiness is also directly aligned with the statutory objectives that guide the Board's regulation of building construction: EV readiness promotes energy efficiency and public safety, and significantly reduces the installation cost of charging infrastructure.

Accordingly, **the Board should adopt the EV-Ready Proposal subject to the important recommendations outlined herein.**

[1] *See* STATE ZERO-EMISSION VEHICLE PROGRAMS MEMORANDUM OF UNDERSTANDING (Oct. 24, 2013), *available at* http://www.zevstates.us/about-us/.

I. EV-Ready Code Requirements are Aligned with the Board's Guiding Objectives and the Commonwealth's Long-Term Prosperity.

The statutory objectives that guide the Board's adoption of new building standards recognize the important role that buildings play in Massachusetts' broader energy system, as well as the building code's capacity to provide significant energy benefits and cost savings to residents through sensible, forward-looking design and construction standards.

As the connection between buildings and transportation fueling grows in Massachusetts, EV-Ready code requirements are essential to reduce construction costs and promote energy conservation and public safety.

A. EV-Ready Requirements Promote Energy Conservation and Public Safety

By statute, the Board is empowered and duty-bound to adopt building standards that promote "energy conservation and public safety."[2] EV readiness is compatible with both energy conservation and public safety. EVs are more energy efficient than internal combustion engines, which results in lower fuel costs and better fuel economy for Massachusetts residents.[3] The facilitation of Level-2 charging, in particular, accords with the Board's guiding objectives. Level-2 charging is more efficient than a wall plug (i.e., Level-1 charging), thus reducing the amount of time required to charge an EV.[4] Additionally, EVs have fewer to none of the dangerous tailpipe emissions that are harmful to human health and welfare.[5]

B. EV-Ready Requirements Reduce Overall Costs to Building Owners and Operators

The Board's authorizing statute identifies as another general objective the adoption of "modern technical methods, devices and improvements which may reduce the cost of construction . . . over the life of the building."[6] EV readiness is well aligned with this objective. Designing and constructing a new building to accommodate EV-charging equipment is significantly less expensive than retrofitting an existing building. The average EV-charging system installation cost for new commercial construction is only a small fraction of the overall construction cost of a new building. In comparison, retrofitting an existing building to

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[2] M.G.L. ch. 143, § 95.

[3] *See Benefits and Considerations of Electricity as a Vehicle Fuel*, ALTERNATIVE FUELS DATA CENTER, U.S. DEPT. OF ENERGY, http://www.afdc.energy.gov/fuels/electricity_benefits.html (May 10, 2016).

[4] EVAN FORWARD, KAREN GLITMAN, & DAVID ROBERTS, VERMONT ENERGY INVESTMENT CORP., AN ASSESSMENT OF LEVEL 1 AND LEVEL 2 ELECTRIC VEHICLE CHARGING EFFICIENCY 9 (2013), *available at* https://www.veic.org/docs/Transportation/20130320-EVT-NRA-Final-Report.pdf.

[5] *See generally* ELECTRIC POWER RESEARCH INST. & NATURAL RESOURCES DEFENSE COUNCIL, ENVIRONMENTAL ASSESSMENT OF A FULL ELECTRIC TRANSPORTATION PORTFOLIO, vol. 3 (2015), *available at* http://epri.co/3002006881.

[6] M.G.L. ch. 143, § 95.

accommodate EV charging can be prohibitively expensive.[7] It simply makes sense to fold EV-Readiness costs into new construction projects.

Importantly, buildings constructed under the amended building code will exist for decades, during which time our transportation sector will undergo a significant shift toward EVs. Preparing for EV charging during design and construction allows owners and operators to select the least-cost arrangement, thus saving costs in the long run.

C. EV-Ready Requirements Support Governor Baker's EV and Climate Action Goals

The proposed EV-ready building code amendments advance Massachusetts' statutory commitments to reduce greenhouse gas emissions 25 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050.[8] Transportation is the single largest contributor to Massachusetts' greenhouse gas emissions, accounting for more than 40 percent of total emissions. Electrification of the state's transportation sector is critical to achieving the Commonwealth's ambitious emission-reduction requirements.[9] Massachusetts' *Clean Energy and Climate Plan* specifically calls for policies to facilitate residential and workplace EV charging, such as the proposed building code amendments, as key to encouraging EV adoption.[10]

Updating the state building code to promote EV readiness is also a priority action under the eight-state Zero-Emission Vehicle Memorandum of Understanding ("MOU"), to which Massachusetts is a signatory.[11] Through this MOU, Massachusetts has pledged to deploy over 300,000 EVs by 2025.[12] State policies designed to accelerate EV ownership, such as the *Mass Electric Vehicle Incentive Program* ("Mass EVIP") and *Massachusetts Offers Rebates for Electric Vehicles* ("MOR-EV"), have contributed to soaring rates of EV ownership in the Commonwealth. Since 2013, the number of EVs in Massachusetts has more than tripled, and EV ownership continues to grow. In the coming decades, residential and commercial buildings will play a significant, growing role in fueling Massachusetts' transportation sector. An EV-ready

---

[7] *See, e.g.*, CAL. AIR RESOURCES BOARD, ELECTRIC VEHICLE CHARGING INFRASTRUCTURE 3 (2015), *available at* http://www.documents.dgs.ca.gov/bsc/2015TriCycle/CAC/GREEN/Exhibit-B-CARB-Cost-Analysis-and-Technical-Report.pdf (finding that EV-ready building codes save $3,750 to $6,975 per parking space as compared to the costs of retrofits); U.S. DEPT. OF ENERGY, COSTS ASSOCIATED WITH NON-RESIDENTIAL ELECTRIC VEHICLE SUPPLY EQUIPMENT 13 (2015), *available at* http://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf (added costs of retrofits may include, for example, the cost of upgrading electrical systems to provide sufficient capacity, and trenching and boring to lay electrical supply conduit).

[8] Global Warming Solutions Act, M.G.L. ch. 21N.

[9] *See generally* UNION OF CONCERNED SCIENTISTS, CLEANER CARS FROM CRADLE TO GRAVE (2015), *available at* http://www.ucsusa.org/sites/default/files/attach/2015/11/Cleaner-Cars-from-Cradle-to-Grave-full-report.pdf.

[10] EXEC. OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS, MASSACHUSETTS CLEAN ENERGY AND CLIMATE PLAN FOR 2020 25-27 (2015), *available at* http://www.mass.gov/eea/docs/eea/energy/cecp-for-2020.pdf.

[11] ZEV PROGRAM IMPLEMENTATION TASK FORCE, MULTI-STATE ZEV ACTION PLAN 20 (2014), *available at* http://www.zevstates.us/about-us/. *See also* STATE ZERO-EMISSION VEHICLE PROGRAMS MEMORANDUM OF UNDERSTANDING (Oct. 24, 2013), *available at* http://www.zevstates.us/about-us/.

[12] STATE ZERO-EMISSION VEHICLE PROGRAMS MEMORANDUM OF UNDERSTANDING (Oct. 24, 2013), *available at* http://www.zevstates.us/about-us/.

building code serves the needs of future residents and businesses, attracts economic growth, and helps ensure the long-term prosperity of Massachusetts.

II. The Board Should Amend the EV-Ready Proposal to Better Meet the Commonwealth's Needs and Goals.

Though Conservation Law Foundation strongly supports EV-Ready building code requirements in general, we respectfully urge the Board to incorporate into the EV-Ready Proposal the following amendments and clarifications. The below recommendations are aimed at ensuring that EV-Ready requirements will better meet the Commonwealth's EV-charging needs and facilitate achievement of the Commonwealth's important public policy goals.

- **The Board should remove the proposed exemption for residential parking spaces located more than 130 feet from the nearest electrical panel or sub-panel**. There is no need for this proposed exemption, which would serve only to thwart the broader goal of EV-Ready building codes: ensuring that new buildings are designed to accommodate future installation of EV charging infrastructure.

- **The Board should remove the proposed exemptions for residential and commercial parking spaces that are separated from the premises by a public right-of-way.** As above, this proposed exemption is unnecessary and counter to the broader goal of EV-Ready requirements.

- **The Board should remove the proposed exemptions for residential and commercial parking spaces that are limited to parking duration of less than one hour**. EV-readiness is important for parking spaces with limited parking duration, as such spaces can play a pivotal role in facilitating EV fueling, promoting vehicle electrification, attracting users, and providing valuable services to the energy system and consumers.

- **The Board should clarify EV-ready space requirements for residential ("R") buildings.** The "Residential Provisions" section of the EV-Ready Proposal states that "EV Ready Spaces shall be provided in accordance with Table N1104.2 (R404.2)." Table N1104.2 (R404.2) specifies that R-3 buildings are required to have at least 50 percent EV-ready spaces, and R-2 buildings are required to have at least 20 percent EV-ready spaces. The "Commercial Provisions" section of the EV-Ready Proposal states that "R buildings with four or more passenger vehicle parking spaces on the premises shall provide EV Ready Spaces for a percentage of parking spaces not less than: a. 5% of first 80 spaces, b. 3% of all spaces more than 80." The Board should clarify whether and how these two sets of provisions apply to R-2 and R-3 buildings that are subject to both the Commercial Provisions and the more stringent Residential Provisions.

- **The Board should remove the condition limiting required residential EV-Ready spaces to the minimum number of parking spaces required by local ordinance.** There is no reasonable justification for limiting required EV-Ready parking spaces to the

minimum number of parking spaces otherwise required by local ordinance.[13] Should a developer seek to install a total number of parking spaces that exceeds the minimum required by local ordinance, the project should remain subject to the proportional EV-Ready space requirements set forth in Table N1104.2 (R404.2). Otherwise, this provision could function as a loophole that could allow local governments to erode the effect of the Code. Residences are an important site for EV charging; the majority of EV drivers do most of their charging at home.[14] The proposed EV Ready space requirements will help satisfy Massachusetts' growing demand for EV charging in tandem with the grown and evolution of the Commonwealth's building stock.

* * *

For the foregoing reasons, the Conservation Law Foundation respectfully urges the Board to adopt the EV-Ready Proposal subject to the important recommendations outlined herein.

Thank you for your consideration of these comments.

Sincerely,

Amy Laura Cahn
Senior Attorney
Interim Director
Health Communities &
Environmental Justice

[13] If this is not the intent of the EV-Ready Proposal, the proposal should be amended for clarification. As written, the EV-Ready Proposal currently reads: "In no case shall the number of required EV Ready Spaces be greater than the number of parking spaces otherwise required by local ordinance."

[14] *See, e.g., Charging at Home*, U.S. DEPT. OF ENERGY, https://www.energy.gov/eere/electricvehicles/charging-home; *Charging Behavior Revealed*, IDAHO NAT'L LAB., https://www.inl.gov/article/charging-behavior-revealed-large-national-studies-analyze-ev-infrastructure-needs/.

Anderson, Robert (DPL)

From: DeSantis, Erin <Erin_DeSantis@americanchemistry.com>
Sent: Friday, December 07, 2018 1:59 PM
To: Anderson, Robert (DPL)
Cc: Gorman, Margaret
Subject: American Chemistry Council Letter of Support / MA Updates to the 2018 International Energy Conservation Code
Attachments: ACC Letter on MA Energy Code Update December 7 2018.pdf

Good Afternoon,

Attached please find the American Chemistry Council's letter in support of Massachusetts' update to the 2018 IECC. Please feel free to reach out to Margaret Gorman, Senior Director, Northeast Region at 518-432-7835 if you have any questions.

Thank you.

Erin DeSantis | American Chemistry Council
Director, Northeast Region
erin_desantis@americanchemistry.com
11 North Pearl Street, Suite 1400 | Albany, NY | 12207
O: 518-432-7835
C: 518-598-6599
www.americanchemistry.com

December 7, 2018

Board of Building Regulations and Standards
Office of Public Safety and Inspections
Division of Professional Licensure
Commonwealth of Massachusetts
1000 Washington Street
Boston, Massachusetts 02118

Delivered Via Email To: Robert.Anderson@mass.gov

Dear Members of the Board of Building Regulations and Standards:

Thank you for the opportunity to provide comments regarding the promulgation of draft amendments to the energy efficiency provisions of the Massachusetts State Building Code including the update to the 2018 International Energy Conservation Code (IECC) for residential and commercial construction. The American Chemistry Council (ACC) and its members support the adoption of the 2018 IECC without weakening amendments and applaud Massachusetts for your leadership in adopting and enforcing the most recent energy codes.

ACC is an Important Stakeholder

ACC represents more than 170 leading companies engaged in the business of chemistry. ACC members apply the science of chemistry to make innovative products and services that make people's lives better, healthier and safer. The business of chemistry is a $768 billion enterprise and a key element of the nation's economy. Chemistry companies are among the largest investors in research and development, investing $91 billion in 2016.

Within Massachusetts, the chemical industry contributes more than $7.9 billion to the economy and is the state's fourth largest manufacturing sector. The chemical industry in Massachusetts provides more than 17,000 direct jobs plus an additional 10,490 indirect jobs and an additional 12,600 jobs in plastics and rubber products. Further, it invests approximately $446 million to build and update equipment and facilities.

The decisions of the Board of Building Regulations and Standards impact ACC's members and their employees. The chemical industry supplies many products and materials to the building and construction value chain, including those that deliver energy efficiency throughout the entire structure. ACC's members are also large users of energy so the responsible use of energy is important to the industry's economic health and competitiveness. Energy efficiency is the lowest cost option for meeting energy demand. Energy efficient buildings create economic opportunities for businesses and industry by promoting new energy efficient technologies and reducing energy waste.

ACC has extensive knowledge regarding building code development. ACC is a partner in recent building science research, including projects with the Department of Energy and Home Innovation Research Labs. ACC representatives serve on the ICC, ASHRAE, ASTM, AAMA, and other code and standard setting bodies.

ACC Supports the 2018 IECC without Weakening Amendments

The chemical industry supports the adoption of the 2018 IECC. Although we understand that some adaptations specific to Massachusetts may be necessary, we caution against weakening the substantive requirements for energy efficiency. The proposed amendments do not appear to weaken the energy conservation provisions and we are pleased to support the update.

Many Technical Resources Are Available to Help

The 2018 IECC provides guidance for practical matters, such as cladding attachments to support constructability and compliance. In addition, manufacturers provide installation instructions for use of their products. Various third-party resources are available to support code compliance with helpful practices for construction. For example, ACC's Foam Sheathing Committee supports the technical information for builders on www.continuousinsulation.org, and ACC's Spray Foam Coalition has excellent resources at https://polyurethane.americanchemistry.com/polyurethanes/Spray-Foam-Coalition/.

Available resources provide a variety of actionable and code-compliant solutions to optimize moisture control, integrate various wall functions and components, and equip builders/designers with conventional or more advanced options for resilient, energy efficient performance. Thus, as with many forms of construction (including conventional framing, advanced wood framing, SIPs panels, ICF forms, etc.) there are significant resources available to support not just one but many reasonable options.

Thank you for the opportunity to offer our comments. For any questions, please do not hesitate to contact me at (518) 432-7835 or via email at Margaret_Gorman@americanchemistry.com. ACC, its member companies and our employees thank you in advance for considering our views.

Sincerely,
Margaret Gorman
Senior Director, Northeast Region
American Chemistry Council

Anderson, Robert (DPL)

From: Sanches, Nicole <nsanches@mapc.org>
Sent: Friday, December 07, 2018 4:33 PM
To: Anderson, Robert (DPL)
Cc: Peterson, Cameron; rdavis@mapc.org; Weyant, Elizabeth; Robins, Leah; kerryd@dietzarch.com; j.couture@town.sutton.ma.us
Subject: MAPC Comment Letter on the 10th Edition of the State Building Code
Attachments: MAPC to BBRS re Comments on IECC2018 and MA amendments_12-7-18.pdf

Dear Chief Anderson:

Thank you for the opportunity to provide comment on the Revised 10th Edition of the Massachusetts State Building Code. Please find attached the Metropolitan Area Planning Council's comments regarding the proposed amendments.

Please contact myself or Cammy Peterson (cpeterson@mapc.org) if you have any questions or would like to discuss our comments further.

Best,
Nicole

MAPC
METROPOLITAN AREA PLANNING COUNCIL

SMART GROWTH AND REGIONAL COLLABORATION

December 07, 2018

Robert Anderson
Chief of Inspections
MA Office of Public Safety and Inspections
1000 Washington St, Suite 710
Boston, MA 02118

Re: Comments on Proposals for the 10th Edition of the State Building Code

Dear Chief Anderson,

Thank you for the opportunity to provide comments on proposals for the 10th Edition of the MA State Building Code. The Metropolitan Area Planning Council (MAPC) is the Regional Planning Agency serving the people who live and work in the 101 cities and towns of the Metro Boston region. We recognize the importance of our state building codes to the safety and wellbeing of those whom we serve. In our work on behalf of cities and towns, we have heard a strong interest in adopting additions to the state code and updates to the stretch energy code that support clean energy and climate mitigation.

The mission of MAPC is to promote smart growth and regional collaboration. The agency's commitment includes protecting the environment, encouraging sustainable land use, and mitigating and preparing for climate change. For many years, MAPC has helped numerous member communities successfully navigate the Green Communities program. We have worked closely with the Department of Energy Resources (DOER) to provide this support and develop recommendations for the continued evolution of the Green Communities program, including the significant role the Stretch Energy Code has played and should continue playing in advancing community-wide building energy efficiency. Another critical strategy in achieving MAPC's mission has been the support and technical assistance we offer to cities and towns to help them transition to clean vehicles. We have collaborated with the Commonwealth on developing a statewide contract for advanced vehicle technologies to provide municipalities and other public entities with easy access to emissions-reducing and cost-saving vehicle technologies. We have also worked with state to aggregate the buying power of state agencies and municipalities throughout Massachusetts to bring down costs and minimize barriers to purchasing alternative fuel vehicle technologies.

Comments

The following comments are in regards to an update to the stretch code, inclusion of EV-ready amendments, and the Mass Save suite of amendments that promote efficiency in commercial and residential buildings.

Stretch Energy Code

MAPC has aided many of its member communities to successfully navigate the Green Communities program designation process and, thereby, to adopt the stretch energy code. In total, 213 of the 351 municipalities statewide have adopted the stretch energy code, including the majority of communities in our region. Multiple communities are advocating for a code that continues to keep pace with – and ideally accelerates – their efforts to mitigate climate change and attain carbon neutrality by mid-century. As such, we too recommend the BBRS strongly consider a net zero stretch code, either as a new higher tier option for communities or as a wholesale replacement to the current stretch energy code. This new stretch energy code could be supported by existing standards such as Passive House Standards, Living Building Challenge, and Architecture 2030.

Electric Vehicle (EV) Ready Amendments

MAPC believes the commercial (C405.10) and residential (N1104.2: R404.2) "EV Ready" requirements set important minimum standards for new construction that arm building owners with the tools to provide clean fuel vehicle options at their sites.[1] By requiring the build-out of the necessary electrical and physical infrastructure at the point of construction, these provisions will help to eliminate the costs borne to retrofit existing properties when deploying an EV charging station. The average cost to retrofit a commercial parking space with an EV charger is about $6,000. However, if a building is EV ready, this cost significantly drops to an estimated $1,800 to $3,000, reducing the financial barrier to installing EV charging stations at new buildings by 50% or more.[2]

The Commonwealth has many successful programs in place that support the advancement of clean fuel vehicles, and the rate of adoption has significantly increased throughout Massachusetts over the past few years. However, according to the Department of Energy Resources, Massachusetts was only 4.6 percent of the way toward reaching its Zero Emission Vehicle (ZEV) target of 300,000 vehicles on the road by 2025.[3]

Requiring the build-out of the necessary electrical and physical infrastructure at the point of construction will serve to facilitate the successful implementation of Eversource's and National Grid's "make ready" programs and the VW Settlement. The MA Department of Public Utilities recently released orders approving proposals from two major utilities – Eversource and National Grid – to accelerate the deployment of EV charging infrastructure in their service territories. Last summer, the MA DEP issued a draft Beneficiary Mitigation Plan outlining how the $75 million the Commonwealth will receive from the VW Settlement will be utilized. A significant component will be the installation of EV supply equipment.

Additional charging station infrastructure is needed to eliminate range anxiety for public and private electric vehicle owners, decrease financial barriers to the installation of charging infrastructure on site, and support the Commonwealth in the transition to clean vehicles. This action further responds directly to An Act Promoting Zero Emission Vehicle Adoption[4], enacted in January 2017, which specifically enables BBRS with the statutory authority to create EV-ready requirements within the State's building code. Clearly, the Governor and State Legislature recognized the importance of this step.

At almost 40%, transportation is the largest sector of GHG emissions in the state. Embedding the electrification of transportation within the building code to the extent possible is critical to achieving the State's Global Warming Solutions Act (GWSA) emissions reductions targets for 2020 and 2050. Ultimately, requiring EV readiness in new commercial and residential construction will enable the Commonwealth to expand the charging infrastructure it needs for the future and will further position the State as a leader in promoting clean technology.

Commercial & Residential Energy Efficiency Amendments

MAPC stands in support of the following amendments to the 10th Edition of the State Building Code, as presented by Mass Save and the International Association of Lighting Designers to the BBRS at the meeting on November 14, 2018. MAPC believes that the proposed changes, if adopted, would advance the Building Code's ability to protect the health and safety of residents of the Commonwealth, clarify sections of the code to promote consistency in interpretation, and better align with commitments and plans of

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[1] The minimum standards require that 4 percent of parking spaces – or at least one space – at new commercial buildings with more than 3 parking spaces be wired for EV charging stations. New homes would require one space to be wired for an EV charging station, or one space per every 2 units for multifamily homes with 3 or more units.

[2] "View Point: Why Building Codes are Key to Electric Vehicle Adoption in the Bay State," *Boston Business Journal*, May 19, 2016.

[3] 14,000 vehicles in 2018.

[4] Chapter 448 of the Acts of 2016

municipalities in our region and throughout the state. In addition, MAPC supports a Commercial Envelope Backstop provision as our communities seek to create more robust, energy efficient building envelopes.

Proposed Commercial Amendments:

Lighting Power Densities, Exterior Lighting Zones, and Reduced Lighting Power (Proposals Number 11-9-2018 and 11-10-2018)

MAPC strongly supports the proposals by the International Association of Lighting Designers to revise section C405.2.2.1 and C406.4. In our work with municipalities in energy efficiency, we too have witnessed the quick evolution of efficient lighting materials available and think it is prudent for our state code to be adjusted for the realities of the current lighting industry. These amendments would serve to provide code officials with a more appropriate expectation in new construction closer to the baseline efficiencies for interior and exterior lighting in the market today.

We also consider the proposed amendments to section C405.4 and to Table C405.4.2(1) regarding the exterior lighting zones to be an appropriate solution to clarify the differences between lighting zones 3 and 4. Allowing local code officials to determine when the use of exterior lighting zone 4 is appropriate gives teeth to their interpretation of the code and should serve to prevent more development than the original code intended to use zone 4.

Daylight Responsive Controls (Proposal Number 11-5-2018)

Considering the documented health benefits of increased daylighting in buildings,[5] we expect that the amendments proposed to C401.2 and C405.2.3 on daylighting controls would contribute to the health and safety of occupants of new construction in our communities. The language that Mass Save has proposed is a modest adjustment to the threshold for daylight-responsive controls that should have a positive benefit for buildings in the state.

Automatic Receptacle Control (Proposal Number 11-7-2018)

We agree with Mass Save that plug loads are becoming a higher proportion of energy used in new buildings. We have seen some of our municipalities apply innovative measures for plug loads in their own building plans to address this and think that it is important for new commercial construction to be built with the ability to easily adapt to future plug loads. This efficiency measure also serves to provide consistent expectations of the energy use of the building, which can help developers maintain commercial tenants and preserve the economic viability of these structures.

Since the language that Mass Save has proposed for section C405.10 would codify language that has been in ASHRAE standards since 2010, we think it has had plenty of time to be tested in practice and can be easily applied to our state codes. Coordination with other standards will also provide an efficiency for the developer and the code official in plan review and creation.

Lab Exhaust System (Proposal Number 11-4-2018)

MAPC supports the adoption of the language proposed by Mass Save for lab exhaust systems as these correctly adjust an important building safety feature. Several of our communities have a high proportion of labs in their building stock, and we anticipate that changes to these sections of the code would directly improve energy efficiency for our communities as new labs are constructed.

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[5] Journal of Clinical Sleep Medicine. Impact of Windows and Daylight Exposure on Overall Health and Sleep Quality of Office Workers: A Case- Control Pilot Study. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4031400/. 2014

Sincerely,

Cammy Peterson
Director of Clean Energy, MAPC

CC: Kerry Dietz, Vice Chair, BBRS
John Couture, Chair, BBRS

Anderson, Robert (DPL)

From: C. Scott Ananian <brookline@cscott.net>
Sent: Friday, December 07, 2018 5:51 PM
To: Anderson, Robert (DPL)
Cc: Linda Pehlke; Jesse Gray
Subject: Comment re: draft amendments to the Massachusetts State Building Code

I am pleased to see the EV Ready language proposed for addition to the Massachusetts State Building Code. Proper provision of EVSE in our parking spaces is both a necessary preparation for the future as well as a prudent health and safety measure to ensure that EVs which are increasingly being purchased in our state can be charged safely, without resorting to extension cords and circuits which are inadequate for the steady-state load of charging. The Select Board Climate Action Committee of the Town of Brookline urged the adoption of these requirements in a letter to the BBRS in April of 2017.

I am also pleased to see that the code allows for the use of standard NEMA 14-50 and NEMA 6-30 outlets. This provides a low-cost means for current builders to provide for EV charging using outlets available in every home store, without requiring the upfront purchase of sophisticated EVSE systems.

However, I am concerned that the current text seems to exempt single family homes and multifamily dwellings under four stories tall from any EVSE requirement. As I understand it, homes in this category are regulated by the IRC, not the IBC, and thus would not be considered members of the R-2 and R-3 categories of the IBC. This seems a significant omission.

If it is unintentional, I suggest the addition of clarifying text to N1104.2 (R404.2), for example, "Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane, and other buildings covered by the Massachusetts Residential Code 780 CMR 51, shall require at least 50% EV Ready spaces."

I feel the intentional omission of single-family dwellings would be misguided: unlike internal combustion cars, which are typically charged at dedicated facilities, most electric vehicles are charged overnight, at home. In addition to convenience, this improves overall energy efficiency by allowing the use of off-peak power. Failure to provide facilities for EV charging in new construction will result in unsafe conditions as home owners attempt to charge their cars using household circuits not intended for continuous use, or via unsafe means such as extension cords from high current range or dryer outlets. As described above, the provision of a proper NEMA 14-50 or NEMA 6-30 outlet is straightforward and inexpensive. New homes should include these to keep homeowners safe as electric vehicles become widespread.

At a minimum, I recommend the EVSE requirements for single- and two-family homes be added to the stretch energy code, with a one-sentence addition to AA 103.1 as follows:

AFTER:

> AA 103.1 R-use Buildings. In all R-use buildings, of four stories or less above grade plane with one or more dwelling units, each dwelling unit shall comply with
> IECC 2018 section R406 of 780 CMR 51.00: Massachusetts Residential Code as amended and all mandatory requirements of Chapter 13 and 51, as applicable.

ADD:

> **In addition, these buildings should be considered R-3 buildings for the purposes of N1104.2 (R404.2) Electric Vehicle Charging Spaces.**

International Code Council
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c: 518.852.6025
dharris@iccsafe.org
www.iccsafe.org

Chairman, Members and Staff of the Board of Building Regulations and Standards (BBRS), please accept the following testimony in support of the adoption of the of the 2018 International Energy Conservation Code (IECC).

As you are aware, the International Code Council, is a member-focused association dedicated to developing model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures.

The IECC is adopted at the state or local level in 49 states, including the District of Columbia, Puerto Rico, U.S. Virgin Islands, Mexico, Abu Dhabi and the Caribbean Community and Common Market (CARICOM: 15 Caribbean countries) through the Caribbean Regional Organization for Standards and Quality (CROSQ). I have attached the statewide adoption chart which shows which version of the International Codes (I-Codes), each state is enforcing.

The International Energy Conservation Code (IECC) helps states and jurisdictions reach energy savings, durability, resiliency, and carbon reduction goals and improve national security. The IECC is developed by the International Code Council and is part of a family of fifteen coordinated, modern building safety codes used throughout the world.

A recent article by Christine Brinker in Builder Magazine illustrates the health and safety contributions of the IECC (http://www.builderonline.com/building/building-science/energy-codes-are-life-safety-codes_9). Building science informs the IECC, controlling heat, air and moisture in buildings. It controls condensation that could otherwise turn to rot, mold and mildew, harming both the structure and health of the inhabitants. Air management protects the safety of the air occupants breathe, such as keeping out pollutants from car exhaust from the garage, and radon from the ground. The IECC also ventilates out harmful indoor pollutants and protects occupants from carbon monoxide from gas-fueled appliances. In addition, the IECC's requirements for tight construction and air sealing helps prevent fire and smoke spread.

The requirements of the IECC help maintain livable temperatures for longer in cases of extreme weather, allowing occupants to "shelter in place". A study after Superstorm Sandy – which left 8 million without power – showed that new energy codes allowed residents to stay in their homes for more days during blackouts triggered by heat waves or cold freezes.

The I-Codes, including the IECC are regularly revised and updated by a national consensus process that strikes a balance between the latest technology and new building products, economics and cost while providing for an acceptable level of public and first responder safety. It is an open, inclusive process that encourages input from all individuals and groups and allows those governmental members that are public safety officials to determine the final code provisions. I am pleased that several MA code officials and organizations participated in the 2018 ICC Code Hearings as well as most recently, the Group A cycle for the 2021 International Codes. The expertise of Massachusetts inspectors, design professionals, builders, contractors, labor representatives and all disciplines interested in building safety are vital to your adoption efforts as well as ours.

International Codes-Adoption by State (DEC 2018)

ICC makes every effort to provide current, accurate code adoption information. Not all jurisdictions notify ICC of code adoptions.
To obtain more detailed information on amendments and changes to adopted codes, please contact the jurisdiction. To submit code adoption information: www.iccsafe.org/adoptions

X = One or more state or local agencies/jurisdictions have adopted an edition of the specific code. However, the particular code is not used as a standard for all buildings. Blank = The specific code has not been adopted by any state or local jurisdiction in the state. "15" = Number indicates the specific code edition that is adopted as a mandatory state minimum.
18 = 2018 Edition 15 = 2015 Edition 12 = 2012 Edition 09 = 2009 06 = 2006 Edition 04 = 2004 Edition 03 = 2003 Edition 00 = 2000 Edition

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCPC	IWUIC	IZC	ICC 700
Alabama	15	15	15	15	15	X	15		15	X	15	X	X	X	X	
Alaska	12	X	12	12			12		X							
Arizona	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Arkansas	12	12	12	09	06	X	06		09	X	X					
California	15	15	15							X	15	X		X		
Colorado	X	X	X	X	15	X	15	X	X	X	X	X	X	X	X	X
Connecticut	15	15	15	15	15				15	X	15					
Delaware	X	X		15	15	X	X		12	X	X	X				
District of Columbia	12	12	12	12	12		12	12	12	12	12	12				
Florida	15	15		15	15		15	X	15	X	15					
Georgia	12	12	12	12	12		12		09	X	X	12		12		X
Hawaii	12	12			X				15							
Idaho	15	12	15	12			12	X	12R/15C		15	*15		X		X
Illinois	09	X	09	09	X	X	09	X	15	09	09	X	X	X	X	X
Indiana	12	03	12	12	06		12		X							
Iowa	15	15	15	15	X	X	X		12	X	15	X			X	
Kansas	X	X	06	X	X	X	X		09	X	X					
Kentucky	15	15	12	12					09/12	X						
Louisiana	15	15	X	15	15		15		09	X	15	X				
Maine	15	15							09	X	15					
Maryland	15	15		15	X	X	X	12	15	15	15					
Massachusetts	15	15		15					15		15	15				
Michigan	15	15	X	15	15	X	15		15/15	X	15	15	X			12
Minnesota	12	12	12	12			12	X	12	X	12					
Mississippi	15	15	15	15	15	X	15		03	X	15	X	X			
Missouri	12	X	X	X	X	X	X	X	09	X	X	X	X	X	X	
Montana	12	12	X	12			12		12		12	15		12		
Nebraska	12	12	X	X	X	X	X		09	X	12			X	X	
Nevada	X	X	X	X	X	X	X		18	X	X	X	X	12		
New Hampshire	09	09	X	09	09			X	09	X	09					
New Jersey	15	15	15 (IBC)	15			15		15	X		15				
New Mexico	15	15	03	X	X		X		09	X	15		X	X		
New York	15	15	15	15	15		15		15	15	15					
North Carolina	15	15	15	15	15		15	15	15		15					
North Dakota	15	15	15	15			15		15	X	X					
Ohio	15	09	15	15	15		15		09/12	X					X	
Oklahoma	15	15	15	15	15	X	15		X	X	15		X	X	X	
Oregon	12	15	12	12			12	09	12							
Pennsylvania	15	15	15	15	09		15		15	X	15		15	15		
Rhode Island	12	12		12	12		12	12	12	12						
South Carolina	15	15	15	15	15		15		09	X	X	X	X			
South Dakota	18	X	15	15			X		09	18	X		X	X		
Tennessee	12	09	12	12	12		12	X	09	12	12	X	X		X	
Texas	03	00	X	X	X	X	X	X	15	X	X	X	X	X	X	
Utah	15	15	15	15	15		15		15		15			X		
Vermont	15	X			15				15		15					
Virginia	12	12	12	12	12		12		12	12	12	12				
Washington	15	15	15	15	X		15	X	15	X	15	15	X	18		
West Virginia	15	15		15	15		15		09	15	15	15				
Wisconsin	15		X	15			15		15	X	15					
Wyoming	18	X	18	18	X	X	18		X	X	18	X	X	X	X	
U.S. Territories	**IBC**	**IRC**	**IFC**	**IMC**	**IPC**	**IPSDC**	**IFGC**	**IgCC**	**IECC**	**IPMC**	**IEBC**	**ISPSC**	**ICCPC**	**IUWIC**	**IZC**	**ICC 700**
American Samoa																
Guam	09	09	09	09	09	09	09				09					
Puerto Rico	18	18	18	18	18	18	18		18		18	18				
Northern Mariana Islands	09															
U.S. Virgin Islands	18	18	18	18					18		18					

November 14, 2018

John Couture, Chair
Kerry Dietz, Vice-Chair
Massachusetts Board of Building Regulation and Standards (BBRS)
Via email at j.couture@town.sutton.ma.us, kerryd@dietzarch.com

Dear Chair Couture, Vice-Chair Dietz, and members of the BBRS,

We, the undersigned organizations, are writing on behalf of three reforms we feel would have significant impacts on the Massachusetts State Building Code. We believe that investment in these will help achieve the energy efficiency goals we have as a Commonwealth, and encourage Massachusetts communities to develop better, safer, and more climate-friendly buildings.

We are writing to support BBRS action in three things:
1) Developing a net zero stretch code
2) Including EV readiness in building codes, as requested by DOER
3) Improving building envelope construction requirements in building codes

The first request is that the BBRS develop a net zero stretch code. Although when the Massachusetts stretch code was first developed it was considerably ahead of the base code, due to the base code catching up, it is no longer a significant improvement. In order to commit to stronger energy efficiency building standards as a Commonwealth, we need to institute a net zero stretch code now. As the Board is likely aware, many communities in Massachusetts are interested in net zero community planning and net zero buildings. A net zero stretch code would give those communities the opportunity to improve how buildings are built now, getting us closer to meeting our climate goals as outlined by the Global Warming Solutions Act.

The second request is that the BBRS include electric vehicle (EV) readiness in the Massachusetts building code. Adding EV readiness to the building code is cost-effective because it is significantly less expensive to design a new building to accommodate EV-charging equipment than to retrofit an existing building. As

more electric vehicles are sold and used in Massachusetts, the need for large-scale EV charging networks is growing more pressing. Our communities are invested in moving to cleaner technology in buildings, transportation, and electricity.

The third request is that the BBRS include stronger requirements for thermal building envelopes in Massachusetts. Improving our building envelope construction ensures that every new building built in Massachusetts is better for the environment and better for residents' wallets. More efficient building envelopes keep residents more comfortable, lower utility bills, and protect resident safety during extreme weather events. Improving building envelope efficiency is one of the simplest, most impactful steps the BBRS can take regarding the current code to get us closer to meeting the climate goals of our communities and of the Commonwealth.

Our three requests - developing a net zero stretch energy code, incorporating EV readiness in the building code, and improving our thermal building envelopes - move us toward reaching our climate goals as a Commonwealth. Furthermore, they will help our buildings be more comfortable, help our communities be better places to live and work, and promote energy efficiency and public safety for all Massachusetts residents.

Sincerely,

Alan Palm
350 Mass for a Better Future

Amy Boyd
Acadia Center

Emily Prince
Bedford Net Zero Advisory Council

Jane Winn
Berkshire Environmental Action Team

James Michel
Boston Clean Energy Coalition

Fran Ludwig
Boston Climate Catholic Movement

Sara Driscoll
Boston Climate Action Network

Francie Nolde
Boxborough Energy Committee

Diane Turco
Cape Downwinders

Tom Kilday
Climate Action Brookline

Adele Franks
Climate Action Now, Western Mass

Larry Yu
Climate Coalition of Somerville

Bradley Hubbard-Nelson
Concord Climate Action Network

Deanna Moran
Conservation Law Foundation

Michael Duclos
Energy Efficiency Associates, LLC

Robert Kvall
First Parish in Bedford Climate Justice Group

Robert Kvall
First Parish Church

Kate Crosby
Green Acton

Emily Greene
Greening Greenfield

Marcia Cooper
Green Newton

Louise Amyot
Greenfield Rights of Nature

Audrey Schulman
HEET

Katy Allen
Jewish Climate Action Network

Susan Farist Butler
Leaving the Carbon Economy

Vince Maraventano
MA Interfaith Power and Light

Nicole Morris-McLaughlin
Marion Institute Southeast Energy Challenge

Carol Oldham
Massachusetts Climate Action Network

Deb Pasternak
Massachusetts Sierra Club

Viki Bok
Mothers Out Front

Rosemary Wessel
No Fracked Gas in Mass

Colin Booth
Placetailor

David Reich
Quincy Climate Action Network

James Michel
Resist the Pipeline

Mike Cavanaugh
Sustainable Braintree

Lise Olney
Sustainable Wellesley

Claire Müller
Toxics Action Center

Katrien Vander Straeten
Transition Wayland

Rickie Harvey
West Roxbury Saves Energy

A9 Green / Total Green Energy Solution, LLC
Save Energy, Save the Earth!

December 27, 2018

Board of Building Regulations and Standards (BBRS)
1000 Washington St
Boston, MA 02118

Reference: N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing

Dear John Couture –

I am writing to you state our concern and share thoughts on the proposed 780 CMR Massachusetts Building Code Amendment/ dated 8/22/2018, Reference: N1103.3.3 (R403.3.3), R403 SYSTEMS – Duct Testing.

Although we think it is a very good idea that metal sheet workers do their own bench testing to troubleshoot and be able to produce better work, we believe that their work needs to be trusted but verified by an independent HERS Rater and/or BPI qualified personnel as stated in the current code. We are opposed to this amendment for the following main two reasons:

1. If approved, this can set a precedent for all other inspection and testing aspect of building construction (i.e. electrical, plumbing, structural, insulation, …). For example, soon insulation companies would be asking to do their own inspection and blower door testing, etc.
2. Although we have not done a thorough study on this, we can say during the past 10 years that we have performed the Total duct leakage testing on hundreds of different projects in more than 95 towns and cities in Massachusetts, we think on the first trial only less than 10% of them have passed the 4CFM per 100 sqft threshold as required by code. Of course, this is only based on our limited data. However, if BBRS is seriously considering approving the proposed amendment, we strongly recommend that BBRS should do it is own study and investigation on this subject per status quo before making a decision.

Hope you take our comments in your consideration before making your final decision and please feel free to contact me at any time if there are any questions in this regard.

Sincerely,

Bijan KHosraviani, Ph.D.
Managing Director
A9 Green / Total Green Energy Solution, LLC

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Anderson, Robert (DPL)

From: Jonathan Humble <jhumble@steel.org>
Sent: Tuesday, December 18, 2018 8:46 AM
To: Anderson, Robert (DPL)
Subject: MA-BBRS 11 December 2018 Meeting - AISI Comments and Recommendations
Attachments: BBRS_2018_12_11_Meeting_AISI_Public_Comments.pdf

Dear Mr. Anderson:

I am calling to see if my comments were heard at the 12 December 2018 BBRS meeting, and if so would you please forward the BBRS reaction to this public comment?

If they were not heard, will they be considered at a future BBRS meeting? If so when will that occur?

Jonathan Humble, FAIA, NCARB, LEED BD+C
Regional Director

American Iron and Steel Institute
Northeast Regional Office
45 South Main Street, Suite 312
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(860) 231-7520
Jhumble@steel.org
www.steel.org

From: Jonathan Humble
Sent: Monday, December 10, 2018 7:39 PM
To: 'robert.anderson@state.ma.us'
Subject: MA-BBRS 11 December 2018 Meeting - AISI Comments and Recommendations

Dear Mr. Anderson:

Attached you will find a file containing observations, comments and recommendations by the American Iron and Steel Institute concerning an item shown on the 11 December 2018 BBRS agenda. We submit these for BBRS consideration.

Unfortunately, due to prior commitments I will not be able to attend in person to present our public comments nor to field questions.
However, if there are any questions following your meeting please feel free to contact me to assist you in the development of the code.

I would also be interested in the reaction by BBRS to our comments, thanks.

Jonathan Humble, FAIA, NCARB, LEED BD+C
Regional Director

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TO: **Mr. Robert Anderson**
Massachusetts Board of Building Regulations and Standards
1000 Washington St, Suite 710, Boston, MA 02118

FROM: **Jonathan Humble, FAIA, NCARB, LEED AP-BD+C**
Regional Director

DATE: **10 December 2018**

SUBJECT: **Massachusetts Board of Building Regulations and Standards (BBRS)**
11 December 2018 BBRS Meeting
Adoption of the 2018 International Energy Conservation Code (IECC) as established by Massachusetts General Law c143, §94(o)
Proposed Section C406.12

I am a Regional Director for the American Iron and Steel Institute, an institute that represents the steel producers of Canada, Mexico and the United States. We are taking advantage of the 11 December 2018 meeting notice by providing comments on a portion of the agenda, as follows:

Subject:
Proposed NEW Section C406.12 reads as follows:
"406.12 Wood Construction. All building framing is comprised of wood members and no metal framing is used."

Observations and Recommendations:

Recommend deletion without substitution:
The concept that wood building framing (e.g. in the case of this proposal wood has a broad application, such as: native lumber, nominal wood framing, engineered wood, heavy timber Type IV, etc. since framing is not defined) is the only candidate that qualifies exclusively for provision is not justified and therefore should be removed without substitution.

Approach: It appears that the promotion of this proposal is based on two attributes; energy and green/sustainable attributes. We question this approach as the provisions are strictly energy related and we question the green/sustainable application for acceptance into the Massachusetts building code energy provisions.

All materials have pros and cons: We would state that all basis materials have their pros and cons. Evidence of this aspect is found when examining the actions by the various energy, green, sustainable and high performance codes, standards and programs in the United States do not find evidence of singling out a single building material as this proposal has done. Instead those national model developers focus on the attributes of the all the basic building materials and allow the building owner and/or design professional to choose what may be in the best interest of the owner and their project requirements. This proposal does not take this into consideration, but rather creates a proprietary provision that impacts the construction market negatively for all other basic building materials.

Cost: In both the development of the International Energy Conservation Code and the alternate ASHRAE Standard 90.1 they take into consideration the either a cost impact or cost benefit analysis as part of their development. Missing from this proposal is how the exclusive recognition for wood will be cost effective for commercial buildings and structures as well as the cost impact of allowing preference to this material as part of the energy regulations. This suggests that solutions to energy compliance as materially based, and not design based as illustrated in the two energy benchmark documents. The net result is the creation of an un-level playing field for competitors to sell their materials.

The "OR" concept: While by all appearances this is an optional provision within the code, the reality is that by providing this material recognition in the adopted code highlights the focus on this single material over other materials, even if it is an option.

Steel: Some of the many aspects about steel the BBRS should be aware of, specifically the production of cold-formed steel framing, that appear to not have been mentioned were:

- The industry has reduced energy intensity per ton of steel produced by 31 percent since 1990,
- The industry has reduced CO2 production per ton of steel by 36 percent of steel shipped,
- Up to 100 percent recyclable product (Varies depending on mill),
- Less scrap and waste during construction (2% on average),
- Steel can be used to comply with the requirements of sustainable design standards such as the International Green Construction Code (IgCC), ASHRAE Standard 189.1 (Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings), and the National Green Building Standard (ICC-700),
- Steel can also provide credit points for green building rating systems like the USGBC's LEED (Leadership in Energy and Environmental Design) and the Green Building Initiative's ANSI/ GBI-01 (Green Building Assessment Protocol for Commercial Buildings), and
- Steel framing can comply with energy requirements as demonstrated by its recognition in the International Energy Conservation Code and ASHRAE Standard 90.1.

In conclusion, we would recommend that if this concept is pursued further it be done with all the stake-holders in attendance (e.g. concrete, masonry, brick, steel, etc.) to assist the State of Massachusetts BBRS in their goals.

If there is interest in this approach please feel to contact me at Jhumble@steel.org to join into, and contribute to, this effort. Thank you for your time.

NAIOP
COMMERCIAL REAL ESTATE
DEVELOPMENT ASSOCIATION
MASSACHUSETTS

January 2, 2019

Mr. John Couture, Chair
Board of Building Regulations & Standards
1000 Washington St., Suite 710
Boston, MA 02118

Re: NAIOP Comments on Proposed New Energy Code & New Stretch Energy Code

Dear Chairman Couture and Board Members:

NAIOP Massachusetts, The Commercial Real Estate Development Association, appreciates the opportunity to submit comments on the proposed new energy codes. NAIOP represents the interests of approximately 1700 members involved with the development, ownership, management, and financing of more than 250 million square feet of office, research & development, industrial, multifamily, mixed use, and retail space in the Commonwealth. The proposed changes will have a significant impact on the real estate industry. While we acknowledge that the Commonwealth is required to adopt the latest version of the International Energy Conservation Code within one year of its publication, some of the proposed changes go beyond the IECC and would add significant costs that could restrict development.

NAIOP is strongly opposed to the following proposed changes and urges the Board to seriously consider the impact they would have on real estate development in Massachusetts:

1) The Massachusetts Amendment to Section C406.1, the Additional Efficiency Packages, go beyond what is required under IECC 2018 and will significantly increase the cost of new commercial and multifamily construction in the Commonwealth.

2) The electric vehicle readiness requirements, which require electrical and physical capacity to accommodate future electric vehicle charging, are in conflict with the building code statute.

3) The changes to the rooftop solar readiness requirements submitted by the Department of Energy Resources in October 2018 (a change to what was submitted at the August 2018 meeting) would directly impact an owner's ability to use rooftop space and change what is now required under existing law.

4) As NAIOP has repeatedly communicated, there is no statutory requirement to have a stretch energy code. The stretch energy code is frequently cited as one of the most expensive aspects of development and, as the base code becomes more energy efficient, the cost to comply increases. It is time for one, uniform energy code throughout the state.

Massachusetts Amendment to Section C406.1 Goes Far Beyond IECC 2018

NAIOP members have expressed strong opposition to the proposed Massachusetts Amendment to Section C406.1, the Additional Efficiency Packages. Under IECC 2018, eight different options for introducing additional efficiency beyond the Code are offered and the designer must choose **one additional requirement.** In the last revision to the Massachusetts statewide energy code three years ago, the text was changed in C406.1 to require the adoption of **two additional efficiency requirements** by the designer. Most commercial buildings have complied with that mandate by designing in more efficient HVAC equipment (option 1) and reduced lighting power density (option 2). The current proposal changes the text again to require **three additional efficiency requirements** of 10 now listed (the August version proposed by DOER featured 11 options, while the October 2018 version features only 10 options). This goes far beyond the statutory requirement to adopt IECC 2018 and will significantly increase the cost of new construction in the Commonwealth.

Furthermore, based on the list of the original 11 options, unless a project is planning to provide most of its electricity with on-site solar, then the designer will be forced to choose as its third additional efficiency option either option 7 (enhanced envelope performance), option 9 (renewable space heating), or the original option 10 (renewable service water heating). Option 10, which appears to have been eliminated, means using air source heat pump (ASHP) water heaters, something that is infeasible in the New England climate unless the heat pump is actually placed indoors, taking up space and creating noise within the building. The use of ASHP water heaters in new commercial buildings is nearly non-existent. Therefore, that would leave options 7 and 9. Option 7 effectively requires wall insulation to be 15% more efficient than Code, which will force the designer to increase the Continuous Insulation (c.i.) under the exterior cladding. NAIOP members have expressed concern about the significant cost to increase the c.i. in their designs from, for example, R3.8c.i. in Code to R7c.i. Thus, option 7 involves significant added construction costs.

Finally, Table 405.3.2(1) Interior Lighting Power Allowances, Building Area Method, has reductions for several building types. Retail light power density (LPD) drops 16% from 1.26 W/sf to 1.06 W/sf, Warehouse LPD drops 27% from 0.66 W/sf to 0.48 W/sf, and Office LPD drops 4% from 0.82 W/sf to 0.79 W/sf. These are forced down another 10% by the Additional Efficiency requirements of Section C406.1 as amended by Massachusetts.

While energy efficiency is a laudable goal, these proposed changes will add significant costs to projects and go beyond what is required under IECC 2018 – the most energy efficient code in the nation. NAIOP urges the Board not to adopt this Massachusetts amendment and to retain the language included in IECC 2018.

Electric Vehicle Mandates in Conflict with Building Code Statute

The new energy code would require Group A-1, B, E, I, M and R buildings with four or more passenger vehicle parking spaces on the premises to provide *EV Ready Spaces* for a percentage of parking spaces not less than:

1. 5% of first 80 spaces,
2. 3% of all spaces more than 80.
3. 20% of spaces in R-2 buildings

As NAIOP has repeatedly communicated to Board members when similar amendments have been proposed and voted down by the Board, the proposed **electric vehicle provisions are in direct conflict with MGL c. 143 §95:**

> *Section 95. The powers and duties of the board set forth in section ninety-four shall be exercised to effect the following general objectives:*
>
> *(a)* ***Uniform standards and requirements*** *for construction and construction materials, compatible with accepted standards of engineering and fire prevention practices, energy conservation and public safety. In the formulation of such standards and requirements, performance for the use intended shall be the test of acceptability, in accordance with accredited testing standards.*
>
> *(b) Adoption of modern technical methods, devices and improvements which may* ***reduce the cost of construction and maintenance over the life of the building*** *without affecting the health, safety and security of the occupants or users of buildings.*
>
> *(c) Elimination of restrictive, obsolete, conflicting and unnecessary building regulations and requirements which may* ***increase the cost of construction and maintenance over the life of the building*** *or retard unnecessarily the use of new materials, or which* ***may provide unwarranted preferential treatment of types of classes of materials, products or methods of construction without affecting the health, safety, and security of the occupants or users of buildings****.*

Clearly, the proposed mandates give preferential treatment to electric vehicles, increase the cost of construction of the building, and will have no impact on the health, safety or security of the occupants or users of the building.

It should be up to the developer or owner, not the Commonwealth, to determine the best technologies to respond to market demand for electric vehicle infrastructure. Furthermore, since the EV charging stations would actually **result in increased energy consumption at the building**, it would appear to be in direct conflict with the above referenced building code statute.

While encouraging residents to purchase electric vehicles may be a worthy goal for the Commonwealth, **the building code is not the appropriate way to encourage the growth of specific sectors of the economy**. We urge the Board to reject this provision and for the Baker Administration to find other ways to encourage drivers to purchase electric vehicles.

Rooftop Solar Readiness Eliminates Flexibility & Changes Existing Language

When the current energy code was adopted in 2016, NAIOP expressed opposition to the draft rooftop solar readiness provisions. One of our key objections was that it would restrict the use of rooftop space. As a result, the Board inserted the following language into the code "Nothing in C402.3.3 shall

require any construction documents to be redesigned or reconfigured so as to create a solar-ready zone area." In the October 2018 redraft from DOER, it drops the existing rooftop solar readiness provisions and replaces it with IECC Appendix CA. While they are similar, IECC Appendix CA does not include the above clause that allows for such needed flexibility. In addition, IECC Appendix CA states that it is not mandatory unless specifically referenced in the adopting ordinance. It is unclear whether or not this would be mandatory in Massachusetts. While NAIOP continues to have many of the same concerns highlighted in the EV section above, we would urge the Board, at a minimum, to clearly state that IECC Appendix CA is optional and not required and to reinsert the above clause.

A Uniform Statewide Energy Code Is Needed

Upon adoption of IECC 2018, Massachusetts should drop the Stretch Energy Code and maintain one, uniform statewide energy code. While the Green Communities Act modified M.G.L. c. 143, § 94(o) to require the energy provisions of the State Building Code to be updated within one year of any revision to the International Energy Conservation Code, there is nothing in the Green Communities Act or any other statute that requires a Stretch Energy Code.

A new Stretch Energy Code that goes beyond one of the most energy efficient codes in the nation would add substantial costs that could affect the viability of projects throughout Massachusetts. Furthermore, it would automatically be adopted in approximately 250 of the Commonwealth's 351 municipalities, without any vote or review at the local level. The substantial costs and potential negative economic impact of the Stretch Energy Code must be considered – particularly as many communities in Massachusetts face a significant shortage of affordable housing. NAIOP members have repeatedly cited the Stretch Energy Code as a significant driver of increasing construction and design costs that contribute to the high cost of housing in Massachusetts. For these reasons, NAIOP urges the Board to reject any efforts to maintain a Stretch Energy Code in Massachusetts.

Thank you for the opportunity to comment on the proposed changes to the Commonwealth's energy codes. Please let me know if additional information is needed.

Sincerely,

Tamara C. Small

Tamara C. Small
CEO
NAIOP Massachusetts, The Commercial Real Estate Development Association